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INTERNATIONAL JOINT COMMISSION

HEARINGS

OF THE

INTERNATIONAL JOINT COMMISSION

IN RE

REMEDIES FOR THE POLLUTION OF
BOUNDARY WATERS BETWEEN
THE UNITED STATES AND
CANADA

HELD AT NIAGARA FALLS, ONTARIO, BUFFALO,
N. Y., DETROIT, MICH., WINDSOR, ONTARIO,
PORT HURON, MICH., AND SARNIA, ONTARIO,
SEPTEMBER 25 TO OCTOBER 2, INCLUSIVE,
DETROIT, MICH., NOVEMBER 10 AND 11, AND
WASHINGTON, D. C., DECEMBER 14 AND 15, 1914



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WASHTON, DISTRICT OF COLUMBIA

INTERNATIONAL JOINT COMMISSION

U.S. and Canada, 1909-

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1914

INTERNATIONAL JOINT COMMISSION.

UNITED STATES.

JAMES A. TAWNEY, *Chairman.*
OBADIAH GARDNER.
R. B. GLENN.

WHITEHEAD KLUTTZ, *Secretary.*

CANADA.

TH. CHASE CASGRAIN, K. C., *Chairman.*
HENRY A. POWELL, K. C.
CHARLES A. MAGRATH.

LAWRENCE J. BURPEE, *Secretary.*

Gift
6-28-51

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HEARINGS OF THE INTERNATIONAL JOINT COMMISSION IN RE REMEDIES FOR THE POLLUTION OF BOUNDARY WATERS.

INTERNATIONAL JOINT COMMISSION,
Niagara Falls, Ontario, Friday, September 25, 1914.

The International Joint Commission met at Niagara Falls, Ontario, on Friday, September 25, 1914, in pursuance of the consideration of the reference in relation to the pollution of boundary waters.

Present: Canada—Th. Chase Casgrain, K. C. (chairman), Henry A. Powell, K. C., Charles A. Magrath, Lawrence J. Burpee (secretary). United States—James A. Tawney (chairman), Obadiah Gardner, R. B. Glenn, Whitehead Kluttz (secretary).

APPEARANCES.

Dominion Government: Dr. Montizambert, C. M. G., superintendent general of public health.

United States Government: Dr. Allan J. McLaughlin, of United States Public Health Service, and Prof. Earle B. Phelps.

Province of Ontario: Mr. F. A. Dallyn, representing provincial board of health.

Municipalities represented: O. E. Does, mayor of Niagara Falls, Ontario; Alderman Cole, of Niagara Falls, Ontario; F. C. Macburney, assistant city solicitor; F. J. Anderson, city engineer, Niagara Falls, Ontario; W. H. Harrison, mayor of Niagara on the Lake, Ontario; Joseph Masters, member of the council, Niagara on the Lake; Dr. H. Logan, medical health officer, Niagara on the Lake; Dr. J. R. Mencke, representing Bridgeburg, Ontario; J. Goodwin, mayor of Welland; Willis Chipman, city engineer of Welland; J. F. Gross, town solicitor of Welland.

Mr. CASGRAIN (chairman of the Canadian section), addressing the meeting, said: As this is the first time the International Joint Commission has met in this locality, it will not be amiss for me to introduce the commission. In the first place, I call attention to the name of the commission. It is "The International Joint Commission." Some of the newspapers have called it all kinds of names, but the International Joint Commission is the name of the commission and it was constituted under a treaty between Great Britain and the United States which was proclaimed in Washington on the 11th of January, 1909. The jurisdiction of the commission is twofold. Under certain articles of the treaty, namely, Articles III and IV, it sits as a court. Either the high contracting parties themselves or the citizens of each country can come before the commission, which, where it sits as a court, hears the witnesses and parties and then renders a decision and gives an order which is final. Such, for instance, was the case of the recent applications of the Algoma Steel

Corporation and the Michigan Northern Power Co., for the building of certain very important works in and across the St. Mary's River.

There is another jurisdiction, and a very important one, which is given by the treaty to the International Joint Commission. This jurisdiction is given to it under Articles IX and X. Under Article IX the high contracting parties agree that any other questions or matters of difference arising between them involving the rights, obligations, or interests of either in relation to the other, or to the inhabitants of either along the common frontier between the United States and the Dominion of Canada may be referred from time to time to the International Joint Commission for examination and report. I wish especially to call attention to the very important duties imposed upon the commission by Article X, which reads in part:

Any questions or matters of difference arising between the High Contracting Parties involving the rights, obligations, or interests of the United States or of the Dominion of Canada either in relation to each other or to their respective inhabitants, may be referred for decision to the International Joint Commission by the consent of the two parties, it being understood that on the part of the United States any such action will be by and with the advice and consent of the Senate, and on the part of His Majesty's Government with the consent of the Governor General in Council. In each case so referred the said commission is authorized to examine into and report upon the facts and circumstances of the particular questions and matters referred, together with such conclusions and recommendations as may be appropriate, subject, however, to any restrictions or exceptions which may be imposed with respect thereto by the terms of the reference.

You will therefore see that the commission has jurisdiction, when the questions are referred to it by both parties, over any questions or matters of difference which may arise between the high contracting parties. It was not restricted to matters of difference arising between them in relation to questions along the common frontier between the United States and the Dominion of Canada, as it relates to any questions or matters of difference between the two countries or the inhabitants of either country.

The question with which we are dealing at the present time is the question of the pollution of boundary waters, and this question is submitted to us under Article IX of the treaty. It is not submitted to us for a decision, but it is submitted to us for a report. I think I can not better set out the object of the present meeting than by reading the letter which was sent to the municipal authorities of the different municipal corporations along the boundary waters between the Niagara River and the Detroit River. This letter is signed by the secretary of the Canadian section and by the secretary of the American section of the commission, and it reads:

SEPTEMBER 3, 1914.

DEAR SIR: I am directed by the International Joint Commission to notify you officially as mayor of Niagara Falls, Ontario, that under the treaty between the United States and Great Britain, signed at Washington January 11, 1909, it is provided by Article IV as follows:

"It is further agreed that the waters herein defined as boundary waters and waters flowing across the boundary shall not be polluted on either side to the injury of health or property on the other."

On the complaint of the people of both Canada and the United States that this provision of the treaty was being violated, the Governments of the United States and Canada, on August 1, 1912, under Article IX of the treaty, referred

REMEDIES FOR THE POLLUTION OF BOUNDARY WATERS.

7

to the International Joint Commission for investigation and report, with its conclusions and recommendations, the following questions:

1. To what extent, and by what causes, and in what localities, have the boundary waters between the United States and Canada been polluted so as to be injurious to the public health and unfit for domestic and other uses?

2. In what way or manner, whether by the construction and operation of suitable drainage canals or plants at convenient points or otherwise, is it possible and advisable to remedy or prevent the pollution of these waters, and by what means or arrangement can the proper construction or operation of remedial or preventive works, or a system or method of rendering these waters sanitary and suitable for domestic and other uses, be best secured and maintained, in order to insure the adequate protection and development of all interests involved on both sides of the boundary, and to fulfill the obligation undertaken in Article IV of the waterways treaty of January 11, 1909?

In order to answer the questions set forth in the first branch of the above reference, an extensive field investigation to determine the origin, degree, and extent of the pollution of these boundary waters was carried out by the commission in 1913. The facts of pollution having been ascertained, as shown by the accompanying progress report, there remains for the commission, in answering the second branch of the reference, to investigate and determine what remedies should be recommended to the two Governments for the pollution found to exist and the means of applying and maintaining such remedies.

Under the plan adopted by the commission for the conduct of the investigation of the second branch of the foregoing reference the following steps are necessary:

1. Securing opinions from leading sanitary engineers upon questions relating to general policy and consultations with the sanitary engineers and sanitarians to be employed by the commission.

2. Hearings to enable all interested parties to present their views and facts as to what remedies they would advise and are capable of installing and maintaining, hearings to include any expert testimony submitted.

3. The collection of all available knowledge and data bearing upon the most approved methods of water purification and sewage treatment.

4. Formulation of advisable requirements for each locality according to local conditions and necessities as shown to exist as the result of the investigation by the commission, and the report of the sanitary experts on the pollution of the boundary waters between Canada and the United States.

Accordingly the commission has obtained the opinions of six eminent sanitary engineers—Messrs. George W. Fuller, Earle D. Phelps, and George C. Whipple for the United States, and Messrs. F. A. Dallyn, W. S. Lea, and Theo. J. Lafreniere for the Dominion of Canada. The testimony of these experts established the broad fundamental principles upon which any remedial action must be based and indicated clearly the procedure which should be followed by the commission.

The commission has now reached the very important step in the plan of procedure providing for hearings to enable municipalities and all interested parties to present their views and facts, including such expert testimony as they may desire to present, as to what remedies they would advise and are capable of installing and maintaining that will prevent or remedy the pollution which now exists in contravention of the provisions of the treaty above referred to.

For the purpose of affording your municipality and its representatives an opportunity to be fully heard in respect to the prevention or remedies for the pollution of the waters of the Niagara River by the discharge of sewage of your municipality in said river, the International Joint Commission will meet in the city of Niagara Falls beginning at 9.30 a. m. on Friday, September 25.

For the convenience of the commission it was suggested that in the meantime you select such representatives of your municipality as you may deem advisable to prepare and present such plans for sewage disposal or treatment as in their judgment would adequately meet the requirements of the foregoing treaty in respect to the pollution of said river.

For your convenience and use in preparing for this hearing I am sending you under separate cover—

1. Copy of Treaty and Rules of Procedure.
2. Copy of the Progress Report on Pollution of Boundary Waters, including the report of the sanitary experts.
3. Copy of the Résumé of Testimony of Consulting Sanitary Engineers.

Yours, truly,

SECRETARY.

I should have said in my opening remarks that the commission is composed of two sections—the American section and the Canadian section—each having three members. The members of the American section are appointed by the President of the United States and the members of the Canadian section are appointed directly by His Majesty the King on the recommendation of the Canadian Government.

Notices of these hearings were also sent to the public health authorities of Canada and the United States and of the different Provinces of Canada and of the States of the Union which are concerned more immediately in the present investigation. I suppose some of you are ready to present your views to the commission and to give us all the information in your power, so as to help us in the very important matter that is involved in this reference.

The following municipalities have been notified of this meeting in Niagara Falls, Ontario: Fort Erie, Bridgeburg, Niagara Falls, Queenstown, Niagara on the Lake, Grimsby, Port Dalhousie, St. Catharines, Welland, Gamsborough Township, Grantham Township, Grimsby North Township, Grimsby South Township, Niagara Township, Bertie Township, Crownland Township, Stamford Township, and Willoughby Township.

O. E. DORES, mayor of the city of Niagara Falls, Ontario. This matter has come to the attention of the officials of the city and has been referred to a committee of members of the city council and the city engineer. I do not know whether the city engineer had knowledge of the full scope of the meaning of your commission. He has a short report, which perhaps he could give you.

Mr. F. J. ANDERSON (city engineer of the city of Niagara Falls, Ontario) said: This is a short account of our sewerage system here, and I shall read it to you:

NIAGARA FALLS SEWERAGE SYSTEM.

The city of Niagara Falls, Ontario, is divided into four districts for sewerage purposes, with separate outlets into the Niagara River. These outlets are spread along a distance of a mile and three-quarters, and have a maximum capacity as follows: Bender Avenue, 32 cubic feet per second; Seneca Street, 22 cubic feet per second; Park Street, 45 cubic feet per second; Ferguson Street, 14 cubic feet per second.

The system is a combined one, and in places is overloaded during heavy showers, as the lateral sewers are in some cases too small. Contemplated extensions to care for the western part of the city would provide for a sanitary sewer with capacity of about 60 cubic foot-seconds and a storm-water sewer to take the place of Muddy Run Creek. The total maximum discharge into the sanitary sewers would then be in the neighborhood of 165 cubic foot-seconds.

The city waterworks plant pumps on an average 4,000,000 gallons of water per day, which would give a discharge in the sewers of about 8 cubic foot-seconds in dry weather. During a heavy rainfall this discharge has been noted to total about 60 cubic foot-seconds.

In the *Résumé of Testimony of Consulting Sanitary Engineers in the Matter of Pollution of Boundary Waters of the International Joint Commission* section 5 should apply to the case of the city of Niagara Falls, Ontario. The ratio of the volume of water in the Niagara River to the volume of sewage from Niagara Falls, Ontario, is so very great, and with the perfect mixture effected in the rapids no local nuisance results.

At any rate, should this city be compelled to treat their sewage a separate plant will be required at each of our outlets, as the cost of an intercepting sewer to carry the sewage to a central disposal plant would be excessive on account of the difficulty of construction encountered along the river bank.

Mr. CASGRAIN. The sewage from this city goes into the river?

Mr. ANDERSON. Yes; directly.

Mr. CASGRAIN. What do you mean by that?

Mr. ANDERSON. A little over a quarter of a mile above the Falls. The intake is at the International Railway Co.'s intake.

Mr. CASGRAIN. Is there any system of water purification here; do you treat the sewage in any way?

Mr. ANDERSON. No; there is no treatment of sewage.

Mr. CASGRAIN. Do you purify the water before consumption?

Mr. ANDERSON. For a while during last year there was chlorination, but there is none now.

Mr. MAGRATH. Is the water safe to drink?

Mr. ANDERSON. It appears to be. The medical health officer will speak as to that.

Mr. MAGRATH. You say in this report of yours:

At any time, should the city be compelled to treat their sewage, a separate plant will be required at each of our outlets, as the cost of an intercepting sewer to carry the sewage to a central disposal plant would be excessive on account of the difficulty of construction encountered along the river bank.

Have you any idea how much such separate plants would cost?

Mr. ANDERSON. No; I have not. Along the river front there is one mile and three-quarters between the different outlets. They are spread all along the river front, and it is all rock along the river, and I suppose the International Joint Commission or the provincial board of health would not ask us to do anything more than probably have screens and a sedimentation tank at each one of these outlets. That, I presume, would best be put below the bank, rather than to pump it up to some separate plant in the town to treat it. A mile and three-quarters of an intercepting sewer along there in the rock construction would cost a good deal more than separate sedimentation tanks at each outlet.

Mr. CASGRAIN. What is the population of this city?

Answer. About 10,000.

Mr. CASGRAIN. It is increasing, I suppose?

Answer. Oh, yes; it is supposed to have increased in the past year about 2,000.

Mr. GLENN. You say you get your water from the upper river—that is, after Buffalo has emptied its sewage into the river?

Answer. Yes, sir.

Mr. GLENN. And yet you say there is no pollution in that water?

Answer. The report of the commission shows that probably there is some pollution there, but I understand that the water has been very good this year.

Mr. GLENN. This year?

Answer. Yes; occasionally there are tests made. The provincial board of health would be able to tell about that.

Mr. DALLYN. I do not think you have any authority for the statement that the water is free from pollution.

Mr. ANDERSON. The medical health officer of the municipality will speak as to that.

Mr. CASGRAIN. What is the total computation of property in the city?

Mayor DORES. About \$6,000,000.

Mr. CASGRAIN. What is the per capita cost of public improvements?

Mayor DORES. I do not think I can tell that.

Mr. CASGRAIN. Can you tell me the per capita cost of administering the affairs of the city?

Mayor DORES. I can not state that offhand.

Mr. CASGRAIN. You can have a statement of the financial standing of the city prepared and sent to us?

Mayor DORES. I can very easily have that done; there is no objection to that.

Mr. CASGRAIN. I would like you to have sent to us a report giving information as to the amount per capita of all the revenues of the city, the amount per capita of the expenses of all the departments, the outlays for public improvements, the value of lands and buildings used by the municipality, the expenses of public-service enterprises, the indebtedness of the city, and the interest on such indebtedness.

Mr. TAWNEY. Mr. Anderson, you said that the intake of the water-works of Niagara Falls, Ontario, is about one-quarter of a mile above the Horseshoe Falls?

Answer. Yes.

Mr. TAWNEY. Where is that intake with reference to Navy Island?

Answer. I think the maps show just where the intake is.

Mr. TAWNEY. There is a map here at page 47 of the progress report, but I do not think there is anything there to indicate where the intake is and how far it is from the shore.

Answer. It is indicated on the map where the intake is with the letters "W. W. intake."

Mr. TAWNEY. I observe from the progress report that the bacteriological examination of the water just below Navy Island shows the presence of 64. Do you know whether the state of health in the city shows the effect of the pollution which exists here?

Answer. The medical health officer will explain that.

Dr. H. LOGAN (medical health officer, Niagara Falls, Ontario). I can not give you any definite report on the matter. We have analyses taken of the water every two months and possibly oftener, and each report varies in its character. The last report we got is the best report we have had yet. I can not tell you just what it is, but it shows that the water was purer three weeks ago than it has been this year or last year. Of course you know that last year our water was very bad. We had possibly 150 or 200 cases of typhoid, and this year we have none at all. There may be one or two cases, and that might show something the matter with the water. It was the water, of course, that produced the typhoid.

Mr. TAWNEY. By whom is this examination of the water made?

Answer. By the provincial analysts.

Mr. TAWNEY. Do you know anything about the source of the pollution that occurred in the water a year ago?

Answer. Where the water got the pollution I can not say, but the fever was from the water. As we went farther up the Chippewa Creek the pollution was worse. That is a very slow river or creek. Where the river is active we do not get so much pollution.

Mr. CASGRAIN. When you speak of the Chippewa Creek you mean the Welland River?

Answer. Yes.. The nearer we get to the mouth of the Welland sewer the more contamination we get in the water.

Mr. TAWNEY. When the water was examined a year ago you say it was bad. Do you remember the number of B. coli to the cubic centimeter of water?

Mr. DALLYN. The water was found to be very much polluted. It is explosive here; pollution only occurs probably for a few hours, once in a week or once in a month. That is the peculiar nature of it. Therefore any indiscriminate analysis will not tell you very much. They have been advised here by their district health officer to continue the chlorination. When a sample comes into the laboratory at Toronto we report on the sample, but not on the local situation.

Mr. GLENN. You said that this year the water is a great deal purer than it was last year, and that last year the farther you went up the Welland River the worse the pollution was. Has anything been done up there to lessen the pollution of the river?

Answer. No.

Mr. GLENN. How do you account for the pollution being so much less this year than last year?

Answer. I can not account for it. I partly accounted for it last year. I think there is a certain east wind that produces that pollution. Our intake is out beyond that quiet stream, and the farther we went up the more pollution we got. I think the pollution last year was due to a certain wind that must have carried it out into the intake. Ninety per cent of our typhoid was within 6 or 10 days. Before that we had very little, and after that we had very little. We had, possibly, about 200 cases in all.

Mr. CASGRAIN. I suppose you are not prepared to advise the municipal authorities of this city to remain in the state they are in now with this danger hanging over your heads?

Dr. LOGAN. If there was any way of remedying it, it would be better for the public health of the city; there is no doubt about that. We chlorinated the water last year for two months. As soon as we found out the source of the infection we started to chlorinate the water. I suppose the system was not the best, but it worked pretty good and it closed out the typhoid. On the 1st of November we started chlorinating the water, and we have done it since. We did not think it was necessary to do so before that.

Dr. McLAUGHLIN. Do you think you could have an adequate idea of the pollution of the stream by an examination of the water every two or three months, when the pollution may occur rapidly—do you think you are justified in making a statement that the water is pure on such a basis as that?

Answer. I do not think so.

Dr. McLAUGHLIN. You may strike a good day each time you take a sample?

Answer. The provincial authorities tell us they have lots to do, and we send the analysis oftener than once a month, but we get a different report each time.

Mr. MAGRATH. Are the people here satisfied with the water supply for drinking purposes?

Answer. We get reports sometimes that they are not, but I think generally they are satisfied.

Mr. GLENN. Did not the reputation of your water last year prevent a number of tourists and visitors coming to this place?

Answer. I think that reputation was mostly got through the newspapers.

Mr. GLENN. It seems to me you deserved it. I am asking that question for the purpose of governing me in the investigation. You people are perfectly satisfied that Buffalo should throw sewage into the river without treatment and without sedimentation.

Answer. It would be better if precautions were taken; but of course our reputation was injured last year very unnecessarily, I think.

Mr. CASGRAIN. You had 200 cases of typhoid here, and that was some basis for your bad reputation?

Answer. Yes; but of course last year typhoid was bad all over this part of the country, and, for that matter, all over the Province.

Mr. DALLYN. The people said the typhoid cases came from Niagara.

Answer. Yes; we had some instances of that. A man came here from Toronto and he took a drink of water and he went back, and two hours afterwards he took typhoid and they blamed it on Niagara.

Mr. GLENN. We are holding this investigation with the end in view of protecting the people of Niagara, both on this side of the river and on the American side. We want to find out whether your people are satisfied with the conditions over here or whether you think there ought not to be something done to purify the water before you drink it. It will be a question for us to decide whether you ought to purify the sewage before you send it down to Niagara on the Lake.

Dr. LOGAN. We certainly would feel more satisfied if it were purified.

Mr. MAGRATH. Is it not a live issue here?

Dr. LOGAN. It is not.

Mr. CASGRAIN. Do you say the question of the water supply is not a live issue in this city?

Dr. LOGAN. Not this year, but it was last year.

Mr. CASGRAIN. And if the same state of things happens that happened last year you would have it a live issue again?

Dr. LOGAN. Yes.

(Mr. Anderson, city engineer, was again called.)

Mr. ANDERSON. I wish to say that we think the pollution last year was caused by the wind blowing from Buffalo.

Mr. CASGRAIN. That same wind may blow again.

Mr. TAWNEY (to Mr. Anderson). Have you any information as to the cost of a purification plant or a sewage-treatment plant, if one were required here?

Mr. ANDERSON. No; we did not think it was absolutely essential that we should have gone into a proposition of that kind as yet.

Mr. TAWNEY. The report of the investigation thus far made by the commission shows conclusively that the waters of Niagara River are polluted from shore to shore. There are cities below you that are using this water and the intakes of whose waterworks are in

the same river, and this very requirement was recommended by the commission to the two Governments with respect to a sewage-treatment plant or purification plant, and I would like to know as to what the probable cost of such a plant would be as would be necessary to meet the requirements of this city.

Mr. ANDERSON. We could get that for you; but don't you think that the readings you have taken along here show, comparatively speaking, that the Canadian side is free from pollution?

Mr. TAWNEY. Above the Falls?

Mr. ANDERSON. Yes.

Mr. TAWNEY. Yes; except the lowest part below Navy Island, where it shows the presence of 64 c. c. Between Navy Island and the mainland, as shown in this report, it is 39 c. c. and 41 c. c., and again, a little higher up, it is 34 c. c. and 36 c. c. That is above the Falls. Do your sewers empty in above the Falls?

Mr. ANDERSON. No; they empty in below the Falls.

Mr. TAWNEY. The report shows that that part of the river I have spoken of is being polluted from shore to shore.

Mr. ANDERSON. Do you think that is caused by Niagara Falls, Ontario?

Mr. TAWNEY. They are contributing to it.

Mr. ANDERSON. The percentage of the sewage is small from Niagara Falls, Ontario.

Mr. MAGRATH. Has your sewage plant had the approval of the Ontario government?

Mr. ANDERSON. It has had it up to date.

Mr. DALLYN. We have no jurisdiction over international boundary waters, so that we have to approve of their plans in order to enable them to sell their debentures. We would not do it in inland waters, but we are doing it in the case of the international waters because we have no jurisdiction.

Dr. McLAUGHLIN. Do I understand you to say that the report shows that the water above the Falls is good for drinking purposes?

Mr. ANDERSON. No; but it looks as if it were comparatively free.

Dr. McLAUGHLIN. I do not think you could make that statement on the report. That report shows an average of 64 c. c., 39 c. c., or 41 c. c. That is a dangerous drinking water. Inasmuch as that is an average and it fluctuates, and is sometimes much worse than that, it would be a very dangerous drinking water at times without purification.

Mr. ANDERSON. I think the deduction from the report is that the pollution is not caused by Niagara Falls, Ontario.

Dr. McLAUGHLIN. It does its share of the pollution, but it is impossible to say what its percentage of the pollution is. There is such a thorough mixture in the Whirlpool Rapids that germs from both sides reach throughout the waters.

Mr. GLENN. What is the population of Niagara Falls on the American side?

Mr. ANDERSON. Thirty-five thousand.

Mr. GLENN. Do you think they do the most of the damage?

Mr. ANDERSON. They certainly do some of it.

Mr. GLENN. You gentlemen ought to get it out of your heads that we are trying to hurt you. Our object is to try and benefit the people on both sides of the river.

Mr. MACBURNY (city solicitor, Niagara Falls, Ontario). The city council have in the past gone to the provincial board of health and laid the matter before them. We do not lay down a sewer without first having the approval of the provincial board of health. We have gone to the provincial board of health from time to time, and the provincial board of health sanctioned the laying of the sewers, with the understanding that when the time comes that your body shall see fit to ask other municipalities to have their sewerage attended to that we will be in the same position as they are and will have to treat our sewage. We are not here in any controversy this morning. As I understand the case, you have come here to learn what you can about our sewerage system to add to your report. The city of Niagara Falls, as the doctor and the city engineer have told you, has no very great complaint against the water that is used here. We do sometimes get a complaint, and, as has been shown to you by the currents in the river, the sewage from Buffalo does not strike the Canadian shore unless heavy winds bring it over. The current is such that it keeps the sewage from Buffalo along the American shore. The result is that in Niagara Falls, N. Y., they have had to put in a plant for chlorination of their water before it could be used. They were having a great deal of trouble there some time ago. We have never suffered from the effect of that, only at certain periods when the wind, which perhaps drives it, has greater force than the force of the current. We must get part of the pollution from the Chippewa Creek, and as Welland and other towns increase in population there is no question that we are going to suffer to a greater extent.

Mr. TAWNEY. What is the population of Welland?

Mr. MACBURNY. Seven thousand or eight thousand, I think.

Mr. GLENN. In going over the report it looks as if the amount of sewerage poured into the Niagara River from large cities like Buffalo has made a great deal of pollution in this river, not only affecting Tonawanda but other points. This report shows that all of this water is polluted to such an extent as to be injurious to health. What we want to know from you is whether at your intake you are getting such impure water as affects the lives of the people in your town. It is for your protection as well as for the protection of those below you.

Mr. MACBURNY. If desired, we could give you the last report of the samples of water sent to Toronto.

Dr. LOGAN. We get so many different reports that we can not learn very much from them.

Mr. CASGRAIN. You can not; as Mr. Dallyn has said just now, you can not judge by one report.

Mr. TAWNEY. One important matter that has not been mentioned with reference to the object of the hearing is that it is to ascertain as far as possible what is the attitude of these communities that are using the water for drinking purposes, and also with reference to the proposal of the municipalities about sewers, so as to remedy the existing condition of the public health on both sides of the line.

Mr. MACBURNY. So far as Niagara Falls is concerned, the condition below does not affect us so much; what we are concerned about is the condition above us.

Mr. CASGRAIN. That is not very charitable.

Mr. MACBURNAY. I admit it is not, but it seems to be natural.

Mr. TAWNEY. The work of the commission is to find remedies for the conditions existing both above and below.

Mr. MACBURNAY. Of course. While this matter has been in the minds of the citizens of Niagara Falls for years, I do not think we have had a great deal of the pollution of Welland bothering us here, but still we realize it is coming to us to a greater extent each year. I think the medical health officer will bear me out in saying that the time will come, and come before very long, when we know that the sewerage from that part will be a menace to the city. I do not think that the sewage from Buffalo affects us very materially. I think it is more what we get from the overland water coming into the river and following along the banks. The current is pretty swift in the center of the river, but the overflow from the swamps is dangerous, and that follows our river banks, and a share of it comes into the water.

Mr. GLENN. There seems to have been some cases of typhoid last year on account of the winds or something else. Do you think if the pollution were stopped above you that it would not be so dangerous?

Mr. MACBURNAY. It would not. The doctor did not mention the fact, but I believe the fact is that last year some of these cases of typhoid resulted from people who had been away at the different watering places, and it was traced directly back to the wells the water was being used from.

Dr. LOGAN. That is correct.

Mr. MACBURNAY. It did not all come from the effects of pollution on the Niagara River, by any means.

Mr. TAWNEY. Did I understand you to say that the city of Niagara Falls, Ontario, would be perfectly willing to carry out any reasonable recommendations that the city might make with reference to this city, as well as the other cities that are polluting the water and using the water in these rivers on the Niagara frontier?

Mr. MACBURNAY. I do not know how you understood me, but my meaning is this: When the time comes that other cities will have to treat their sewage, the city of Niagara Falls will be asked to do the same thing, which we will have to do whether we are agreeable to it or not.

Mr. TAWNEY. Your situation in reference to finances is such that you could do it?

Mayor DORES. I do not know that there is any question about it. The banks are holding us up at the present time, but I feel that the city is still solvent. The city of Niagara Falls has sold its bonds on the market for the highest price for the last several years.

Mr. TAWNEY. The city would not consider it an unreasonable burden if you are asked to do what is right?

Mayor DORES. We would not consider it unreasonable if we are asked to do what other places are compelled to do. If we were asked to do something and the people above us were not asked to do the same thing, we would consider it unfair.

Mr. CASGRAIN. Nothing of that kind will happen.

Mr. MAGRATH. How long have you lived in Niagara Falls?

Mayor DORES. Thirteen years.

Mr. MAGRATH. How many epidemics of typhoid have you had in that period of time?

Mayor DORES. So far as I know, last year was about the worst one we have had. The doctor tells me there has been only one in six years.

Alderman WILLIAM COLE. Up until last year it was a rare thing to get a case of typhoid; it was just as scarce as hen's teeth. We hardly knew the name of it up to a year ago, as far as the city is concerned.

Mr. GLENN. What do you think caused it last year?

Alderman COLE. That I do not know; the doctor has explained it. Leaving aside the shore water, I may say that if you take the water in Niagara River, taking it from the blue water in the center where it goes over Horseshoe Falls, I believe it is as good water as you have in Canada or anywhere else.

Mr. CASGRAIN. Is that because it is blue?

Alderman COLE. When they tell you the winds will blow to such an extent as to affect the sewage from the American side to the center of the river, or drive it across to this side, it is all nonsense. Above the rapids that water runs at 25 miles an hour, and it is churned up to such an extent that if any sewage gets in it is pretty well purified before it comes to the Horseshoe Falls. If our intake was extended farther out, we would get the blue water, and we would want no filtering, or anything of that sort.

But we have to consider the people down the river. Where our intake is at the present time the most trouble has come from our own side and from the Chippewa Creek and from the pasture land. If we had that intake extended, so far as Niagara Falls is concerned, I think we would get as pure water as there is anywhere else in the country.

Mr. GLENN. What was the condition with regard to typhoid on the American side when you had typhoid bad on this side?

Alderman COLE. It was a common thing for them to have typhoid on the American side, only they did not publish it in the newspapers and let all the world know about it. The papers over there would come out with the statement that there was not a case in the city, but they had their building outside the city, and as soon as there was a case of typhoid they would send it out there, and so there was no trouble in saying that there was not a case in the city. But it was a different thing on this side. When we had the typhoid here a year ago, I took up an Old Country paper, and in that paper I saw the statement that they were dropping dead in the streets of Niagara Falls, Ontario.

Mr. TAWNEY. Before you sit down I would like to call your attention to some figures for the purposes of records. It appears that in 1906 there were 3 deaths from typhoid; in 1907, 3; in 1909, 2; in 1910, 8; and in 1912, 4. They figure 12 cases of typhoid to 1 death. In 1902 there was none, in 1903 there was none, in 1904, there was none, in 1905 there was none. Since 1906 you seem to have some deaths from typhoid every year.

Dr. LOGAN. Most of these deaths came from well water. In one case a whole family died from drinking well water.

Alderman COLE. And the city took the matter up at the time and closed the wells.

Mr. MACBURNAY (assistant city solicitor). Sometimes a city may be asked to do something for which they have not the money nor the means of providing the money. If we are required to build either a sewage-disposal plant or a plant for the filtration of water, we will need money. It is sometimes impossible to get the people to vote for money by-laws. If the suggestion could be put in your report that the provincial government would give us power to float bonds for the purposes you desire us to improve on, it would help us materially in getting the money.

Mr. DALLYN. That legislation exists now for waterworks and sewage.

Mr. MACBURNAY. We have to have the provincial board of health authorize the proposition.

Mr. DALLYN. If your council passes a unanimous resolution, asking the provincial board of health to insist upon a plant, they will do so.

Mr. MACBURNAY. That, perhaps, is not possible sometimes.

Mr. CASGRAIN. Mr. Mayor, I would like you not to be under the impression that we can render any binding decision in any particular case on this reference. We do not render any decision in this matter. We report to both Governments, and then each Government, or both Governments together, can take whatever action it thinks proper.

Mayor DORES. I understand that. A report has been read here showing that we have had a large percentage of deaths from typhoid. It is not compulsory on any municipality to publish these deaths, and the question is whether we have not been too good in that respect here and publish our deaths, whereas another city has not published them, and therefore the result would not be of any value for the purposes of comparison. So far as that is concerned, I think if the truth were told our percentage would not compare very badly with that of other places.

Mr. GLENN. I wish at the beginning of the investigation to disabuse the minds of you gentlemen of any idea, if you entertain it, that the object of this commission is to injure any of the communities by publishing reports as to their state of health. That is not the object. The object is to consider the conditions and provide a remedy, so far as we can, for the safety of public health, and it seems to me that all the municipalities should be willing to help themselves and help others in this respect. We are not here for the purpose of publishing death rates, but for the purpose of providing a remedy for the general protection of the health of the people.

Mr. TAWNEY. It may be well to call your attention to the fact that the function of the commission with respect to this investigation is to report our conclusion as to the fact of the pollution and our recommendations as to remedies. It is up to the two Governments then to put these recommendations into effect or not, as they see fit, and it is the desire of the commission, so far as we can, in making our recommendations to conform to the necessities of each case along these boundary waters, and if possible have the public sentiment with us in support of our recommendations, and thus enable the two Governments to carry out these recommendations.

Mayor DORES. Do I understand that there will be a report about the city of Niagara Falls, a report about Welland, and so on?

Mr. TAWNEY. That is a subject on which we have not reached a conclusion, but the report will be on the whole subject matter of the investigation when the final report is made.

Mayor DORES. I suppose the municipality will receive a copy of the report.

Mr. TAWNEY. Oh, yes. It will be some time before the report is prepared, because we have only just commenced the investigation of the most important branch of the reference, which is the remedy for the pollution.

Alderman COLE. In the event of the Niagara River being polluted, Buffalo, for instance, would be compelled to treat their sewage, and the other towns along the line would have to do likewise.

Mr. CASGRAIN. You may rest assured we will not single out any municipality for unjust treatment. So far as I am advised at present, the report will be a general report. We may have to go into some details, but we are approaching this question in the most friendly spirit toward the municipalities.

Alderman COLE. If your report would recommend the treatment of sewage for Niagara Falls and allow Welland and other places to go free, I do not think it would be fair.

Mr. CASGRAIN. We would not think it would be fair, either. Do not be disturbed about that.

Alderman COLE. I do not think other municipalities above us should pollute the Niagara River. If one is compelled to take measures, the others should be compelled for the safety of the general health.

Mr. CASGRAIN. Certainly.

Alderman COLE. If that is done and all are treated alike, nobody will have a grievance.

Mr. CASGRAIN. Certainly.

Mr. GLENN. When I came over here I thought Buffalo was responsible for the whole business, but you are getting so scared now that I think you people have something to do with it. I have been trying to protect you from Buffalo, but I am getting suspicious about you now.

Mr. COLE. I do not think we get any of the Buffalo sewage into our intake.

Mayor DORES. I hope the commission has not got the idea that we are trying to avoid any just responsibility. That is not the intention of the representatives of the city.

Mr. GLENN. If it is found that Buffalo is doing all this damage, they ought to be made to stop it, and if you are doing all the damage, you ought to be made to stop it also. In the meantime, I do not believe that a city of 10,000 population is doing as much damage as a city of 600,000 population.

Mr. MACBURNAY. We do not believe that Buffalo is damaging this side of the river.

Mr. GLENN. I am glad to hear that; we in the United States never did want to injure Canada.

Dr. McLAUGHLIN. It is perfectly useless to discuss the origin of typhoid cases. We have a definite knowledge of the condition of the water, and the condition of the water at your intake is such that

you can expect to have typhoid fever, and unquestionably you will have it as long as you drink that water without purification. The analysis of the water once in two or three months is absolutely worthless as an index of the condition of the water. You will have a good day and a bad day.

You would have to take the daily averages over a long period of time to get a correct idea. There is no question about your duty to purify your water supply all along. There is no use trying to dodge and get behind by saying that those nuisances come from summer resorts, or anywhere else. You have such a water here that unless you purify it you will have typhoid from it. It is not a question of where the typhoid cases come from. The raw water is in a condition now that unless it is purified it is dangerous, and there is no getting away from that.

Mr. CASGRAIN. Dr. Montizambert, have you any questions to put?

Dr. MONTIZAMBERT. I have not. I am here to learn and not to teach.

Mr. CASGRAIN. Mr. Dallyn, have you any suggestions to make?

Mr. DALLYN. If the medical health officer would give us the number of dwellings in the municipality, the number of waterworks connections, the number of sewage connections, the number of outhouses, it would be useful to us.

Mayor DORES. We are doing away with the outhouses all the time.

Mr. CASGRAIN. Can we expect you will send us that statement very soon?

Mayor DORES. We will get it up at once.

(Dr. Mencke, of Bridgeburg, presented himself before the commission.)

Mr. CASGRAIN. What representations have you to make to the commission?

Dr. MENCKE. If there is any particular matter you wish to ask me about, I shall be glad to answer questions with respect to us. We have received a letter from the secretary of the commission and the progress report of the commission, and I am here in response to that letter. I gave one of the copies of the progress report to the medical health officer. The population of Bridgeburg is 2,019. We are situated on the Niagara River, directly opposite lower Buffalo and Black Rock. The International Bridge divides the municipality into the north and south wards.

Mr. CASGRAIN. What is the extent of the municipality along the river?

Dr. MENCKE. We have approximately a mile of frontage on the Niagara River.

Mr. CASGRAIN. How far back do you extend?

Dr. MENCKE. We go back about a mile and a half. The total area is less than 680 acres.

Mr. CASGRAIN. Have you a system of sewerage?

Dr. MENCKE. Yes.

Mr. CASGRAIN. What is the system?

Dr. MENCKE. It was designed by Mr. Ross, a civil engineer, of Welland. We have a complete plant for sewage, with a septic tank, divided into three compartments. We have complied with every regulation that the provincial board of health has required from us. At first they gave us permission to drain directly into the river at

one street, namely, the Jarvis Street sewer, which was put in about 10 years ago. Later we applied for the privilege of draining the old village into the Niagara River directly, and we were refused that and were asked to acquire a sewage-disposal property, which we did. We paid \$4,000 for the land, and we spent about \$8,000 on the septic tank.

Mr. CASGRAIN. Then none of the sewage goes into the river now?

Dr. MENCKE. Until recently the original sewer emptied directly into the river. This summer we have had that connected with the main sewer which runs along Niagara Street. That has only been done in the last six weeks.

Mr. CASGRAIN. What disposal is made of the sewage?

Dr. MENCKE. It runs directly into the septic tank, and there is no treatment used other than bacterial treatment; there is no chemical treatment used.

Dr. McLAUGHLIN. The entire discharge is at one part?

Dr. MENCKE. Yes.

Mr. CASGRAIN. Where do you take your drinking water from?

Dr. MENCKE. The Niagara River, above the International Bridge.

Mr. GLENN. Above Buffalo?

Dr. MENCKE. Oh, no; within a hundred yards practically above the International Bridge.

Mr. TAWNEY. Do you know whether the old intake to Buffalo city was above the International Bridge?

Dr. MENCKE. Yes; it was considerably above.

Mr. TAWNEY. Where is your intake with reference to the old intake?

Dr. MENCKE. I can not answer the question; it is one and a-half miles below that.

Mr. GLENN. What is the condition of your water?

Dr. MENCKE. We have had various samples taken at different times. I was health officer at the time the test was made originally. It showed no intestinal bacilli of any kind.

Mr. CASGRAIN. Have you had any outbreaks of typhoid?

Dr. MENCKE. Yes; we had one this spring. The Michigan Central Railway pump their own water from the river with simply a well running in. The fish got into that well this spring, along about March, and they were pumping it into the Michigan Central tanks; five cases broke out and two of the men died. They pumped 11 bushels of minnows out of the tank when they went to clean it. Since that time they are taking the water from the town supply, and not to my knowledge has there been a case since last May. We are particularly free from typhoid.

Mr. GLENN. Where does Buffalo discharge its sewage; below or above your intake?

Dr. MENCKE. Part of it above. They have one discharge at Ferry Street, I think, and the other is below the International Bridge. We have never thought that the sewage from Buffalo—on account of the depth and the rapidity of the current—damaged us to any extent. Our only fear is from the municipality of Fort Erie, which lies directly above us, and it may be dangerous. They are putting in their sewage there, and we are particularly anxious that our water supply will not be polluted in any way by the discharge from Fort Erie, which is not treated. We are in a position now, with our sewerage

system at the present time and our main sewer, that we can take care of Fort Erie sewage in the future, if the municipalities come together on it. We have a 24-inch main sewer running directly along Niagara Street, which is along the river.

Mr. TAWNEY. You do not treat the water?

Dr. MENCKE. No; I have been drinking it myself out of the tank without boiling it for the last 11 or 12 years. We have had no general epidemic. In a railroad village such as ours is a great many of the men are drinking the water all the way between our municipality and St. Thomas and Sarnia, and they are not very careful sometimes as to where they get their drinking supply along the road. There has been more fever among the railroad employees than among the people generally in the village outside of railroad employees. In looking over the progress report of the commission I can not ascertain whether the samples have been taken directly from our intake pipe. I do not notice in the report that there was any sample taken directly from that point. There were samples taken a considerable distance above it at Ferry Street in the municipality of Fort Erie, but I can not see that any sample was taken within a mile of where we take our supply from. We are particularly anxious that the municipality of Fort Erie above us should not put its sewage directly into the Niagara River, because in that case our water supply would be menaced.

Mr. TAWNEY. How far is it from Bridgeburg to Fort Erie?

Dr. MENCKE. The municipalities adjoin each other, but the distance from the center of Bridgeburg to the center of Fort Erie is about one mile and a quarter. The northern border of Fort Erie would be a little over half a mile from our intake. Our town is half a mile below and half a mile above the International Bridge.

Mr. MAGRATH. I gather from what you say that you would be satisfied if those above you would treat their sewage as you treat yours.

Dr. MENCKE. There is a point that should be remembered. Under ordinary circumstances the sewage being discharged from a septic tank may be pure, but under storm-weather conditions you may have a discharge that would pollute the water. There may be times that no matter how carefully the septic tanks were being operated there would be an overflow which would hurt the condition of the water supply.

Mr. MAGRATH. Are you treating your sewage?

Dr. MENCKE. No.

Mr. MAGRATH. Is your system satisfactory to the public-health department of the Province of Ontario?

Dr. MENCKE. It was put in under their direction. When I saw Dr. McCullough last in Welland, he described at great length a new septic tank which had been in operation at Essen in Germany, and while I was pleased to know there was such advance made in science I foresaw that in the future we would have to discharge perhaps our septic tank and put in the new system. I told him that at the time. It was with mixed feelings I learned about the new tank.

Mr. GLENN. On the American side of the line we have been told by our President that we must be careful in mentioning anything about Germany. You say you want these people to purify their sewage system so as not to pollute your water. You are willing, I

suppose, to take whatever precautions you have the financial ability to provide?

Dr. MENCKE. We are somewhat in advance of all the other municipalities at the present time. We put in a tank under the direction of the provincial government. If we are asked to give any further treatment, we will have to comply with it, of course. I think we have complied with the regulations very well up to the present time. There is nothing below us, except some summer resorts, until we come to Niagara Falls.

Mr. TAWNEY. Your septic tank is without sedimentation?

Dr. MENCKE. Yes; there are three compartments in it.

Mr. TAWNEY. If you had sedimentation plus screening, would not that be sufficient?

Dr. MENCKE. I think that is a matter for the provincial board of health to determine, and also for this commission to decide, and not for me.

Mr. TAWNEY. What additional expense would you be put to in order to add screening?

Dr. MENCKE. I am not in a position to answer that question; I am not an engineer.

Mr. MAGRATH. You feel that your people would be willing to do anything that this commission might decide it is reasonable to call upon them to do?

Dr. MENCKE. You must remember that we are a small municipality compared with some of the cities, who are the greater offenders. We are living opposite the city of Buffalo, and I can remember when I came to Bridgeburg seeing enormous scows carrying all the sludge from Buffalo out to the Canadian side of the river until we got the Government cruisers after them. That has been done away with in recent years, and we have not had any more dumping on the Canadian side of the boundary line. But we are still having that enormous pollution from the city of Buffalo, and while we have been fortunate in the past yet it must always be a menace.

Mr. CASGRAIN. It seems to me that you have done more in the right direction than any of the Canadian municipalities we have heard from so far.

Dr. MENCKE. That is our opinion, and I am glad you agree with it. I may say in regard to Fort Erie sewage that we are in a position to take care of that through our septic tank. That seems to be the only way in which we can safeguard our own water supply. Fort Erie takes it from the lake above. If the municipalities were amalgamated—I do not think there is any immediate prospect of that, but if some arrangement could be made—we could take our water supply above Fort Erie, and they would give us their sewage to take care of, and our sewage plant would do for both the villages. That, I think, would be a good arrangement.

Mr. TAWNEY. How large a place is Fort Erie?

Dr. MENCKE. The population is about 1,300. There is quite a summer population there.

Mr. CASGRAIN. One thousand three hundred would be the maximum in the summer time?

Dr. MENCKE. I think so. Of course it is settled all along the shore for several miles. That is a point I wish particularly to impress upon the commission in regard to the Fort Erie sewage disposal.

They are without sewage disposal at the present time, and I do not know whether they will put in a plant or not. Unless some system is devised to purify that sewage I can see that our water will be very apt to be polluted.

Mr. CASGRAIN. Perhaps Mr. Dallyn will give us a description of the septic tank that has been erected in Bridgeburg?

Mr. DALLYN. The term "septic tank" is used loosely. What they have is a sedimentation tank of a shallow type, not of a newer type, which would be the deep type. For future requirements for a number of years they have adequately met any reasonable demand that might be made upon them. They have actually spent at Bridgeburg \$50 per capita for sewage and sewage disposal, which is very abnormal throughout the whole of North America, the normal being somewhere around \$20 to \$25 per capita. They have met all the reasonable requirements of the provincial board of health, and I think they have anticipated any requirements that you will recommend. They have not instituted chlorination or disinfection of the sewage other than that they have met with every reasonable demand. I think Bridgeburg is to be congratulated.

Mr. CASGRAIN. Under the circumstances would it be necessary for them to chlorinate their sewage?

Mr. DALLYN. I think possibly it would be advisable.

Mr. CASGRAIN. Under the present circumstances is there any danger of the sewage which originates in Bridgeburg crossing the river to the other side?

Mr. DALLYN. No; it may affect international navigation, but not any of the municipalities on the other side.

Mr. GLENN. What do you think of the suggestion this gentleman has made with regard to the Fort Erie sewage?

Mr. DALLYN. They have not at present any sewage treatment at Fort Erie at all. What they are agitating for is a system of sewerage there now.

Mr. W. H. HARRISON (mayor of Niagara on the Lake). One thing seems to be clear, and that is that while the water appears to be all pure up here it is very bad when it gets down to us. Our population is about 1,400. The regular population amounts to that, but in summer time we get over 2,000, and when the camp is at Niagara on the Lake we have sometimes as high as 6,000 people. Of course the camp does not use the sewerage system to any extent. The camp runs from 2,000 to 5,000 and 6,000 men, and that gives us some difficulty in the supply of water. Our sewerage system is not an elaborate one. It started on a small scale some 50 or 60 years ago. It consists of one 12-inch pipe and it is delivered out in the lake. We have nobody below us or near us to complain about our sewage.

Mr. CASGRAIN. How far out into the lake does it go?

Mr. HARRISON. Probably one-quarter of a mile from the mouth of the river; the pipe runs out about 500 feet. There is no town near us that takes that water. We get our water from the Niagara River. The water in the river is always bad, there is no doubt about that. Dr. Ernest Wilson, who was in the camp, will bear me out in that. We are chlorinating our water and chlorinating it all the time. The people have objected to that. There are some times at which they criticize the council for having the water chlorinated.

Mr. CASGRAIN. Is that the only source of water supply you have?

Mr. HARRISON. That is all, and there is none other possible unless we come up as far as St. Davids, which is 7 or 8 miles away, and tap the springs, but the cost of that is entirely out of the question for a small town.

Mr. GLENN. You say the water is bad?

Mr. CASGRAIN. It is awful, according to the reports.

Mr. GLENN. What epidemics of typhoid have you had?

Mr. HARRISON. We have more or less typhoid every year.

Mr. CASGRAIN. The report shows that the water is very bad.

Mr. HARRISON. We have a new doctor there at present, and he is more advanced than the other gentleman, and he claims chlorination is necessary. When our military camp is there they inspect the water every day, and they claim that with chlorination it is generally good. The analyst they have during the camp takes tests several times a day and looks after it very thoroughly, and they insist on thorough chlorination.

Mr. CASGRAIN. Do they take the town water supply for the soldiers?

Mr. HARRISON. Yes; the camp ground has a pipe, and they insist on the water being chlorinated, and if they find it polluted they let us know.

Mr. POWELL. Do you resort to filtration at all?

Mr. HARRISON. No. I think the cities and towns above us ought to put in a filtration plant for us and save us from treating the sewage. There is no other point between Niagara Falls and Niagara on the Lake that takes its water from the river.

Mr. POWELL. You claim they should resort to filtration above you?

Mr. HARRISON. We can not get pure water or water that is fit to drink unless there is something done. The water when it gets down to us is not only polluted, but turbid.

Mr. POWELL. What are the views of the public health authorities in the town as to what should be done above? Is it that sedimentation should be resorted to?

Mr. HARRISON. They are unanimous in believing that something should be done.

Mr. POWELL. Have not their thoughts been crystallized into some demand?

Mr. HARRISON. I can not say that they have, because that question has not been before the public very prominently. The officials of the town have discussed it at various times, of course, and we have been negotiating with the Dominion Government to try and cooperate with them to try to get a pure supply of water for the town and the camp. They recommended a scheme, and they were going to pay the whole expense of filtering the water, but the cost was about \$12,000, and for various reasons that was shelved. We endeavored to take the matter up this year, but they would not listen to it. Dr. Wilson is down at camp every year, and he could tell us something about it.

Mr. GLENN. After you have treated the water, is it practically pure?

Mr. HARRISON. The report comes back when we are chlorinating it is pure.

Mr. GLENN. How much does it cost your city to chlorinate?

Mr. HARRISON. I do not think it costs more than \$150 a year.

Mr. CASGRAIN. Do the people object to the chlorinated water?

Mr. HARRISON. I think they do. Some of them say that the reason we do not have much typhoid when the water is chlorinated is because the people won't drink it.

Mr. GLENN. It gives them an excuse not to drink water.

Mr. HARRISON. The amount of chloride we use is two parts to the million, which is three or four times above what is required for the blue water up here. We have to use an excessive amount of chloride. The doctor put the amount of chloride down, and we find it is not sufficient.

Dr. McLAUGHLIN. You have been told by experts that unless you keep it up it is not effective with such high organic conditions in the water, and when you use enough chloride you have this abominable condition?

Mr. HARRISON. That is right. If the chlorination was satisfactory, it would be all right.

Mr. CASGRAIN. You should not be obliged to drink this water chlorinated.

Mr. HARRISON. Oh, no; we can smell it from the taps.

Dr. McLAUGHLIN. You have been informed by experts that a filtration plant is necessary?

Mr. HARRISON. Yes.

Dr. McLAUGHLIN. They have suggested to you that if you have the best kind of filtration plant known it would have more than its hands full in taking care of such bad water?

Mr. HARRISON. We understand the plant would have to be cleaned quite frequently. The difficulty about water is that the people use about 150,000 gallons, and in summer time 750,000 gallons. We would have to install a plant capable of handling 1,000,000 gallons a day. It is for that reason that we have been negotiating with the militia department.

Mr. POWELL. Do not the experts whom you have consulted think that there would be thrown on the purification plant an undue burden?

Mr. HARRISON. The people feel that way. I do not know what the experts feel about it.

Mr. POWELL. What do you complain of? Do you complain that the people above are not pursuing the course they should pursue in the matter of the purification of the water before it reaches you?

Mr. HARRISON. I say most emphatically that they are polluting the water.

Mr. POWELL. And that as things are there would be an undue burden thrown upon any purification plant you might install?

Mr. HARRISON. I do not know about that; but I do know we would have to install a very large purification plant by reason of these conditions.

Mr. POWELL. I do not think it would make any difference whether it would be large or small, there would be an undue burden thrown upon it.

Mr. HARRISON. They tell us that, no matter how good the purification plant we had, we would have to use chlorine.

Mr. MAGRATH. And would that be satisfactory?

Mr. HARRISON. Not at all. The doctor told us that the water would cause more or less intestinal disarrangement.

Mr. TAWNEY. In the judgment of your experts, the remedy is to reduce the pollution above on the Niagara River?

Mr. HARRISON. There is no doubt about that.

Mr. POWELL. Has this ever been a subject of litigation? Has the riparian proprietor lower down the stream, whether an individual or a corporation, ever tested the point as to his being entitled as a matter of law, both in the United States as well as in Canada, to have the water flowing to him in a state of nature?

Mr. HARRISON. It has not been a matter of litigation in our locality.

The CHAIRMAN. Is that all you have to present?

Mr. HARRISON. I think so, unless you want some special information. Of course I have no information such as you are asking for from these other gentlemen. If you want from us such information as you are asking Niagara Falls to provide with regard to assessment and debt we can provide it.

The CHAIRMAN. We would like to have it. Our secretaries will send to each municipality along the river here a statement of exactly what is desired.

If there is any other gentleman who would like to address the commission now we shall be glad to hear him.

STATEMENT OF JOSEPH E. MASTERSON, OF NIAGARA ON THE LAKE.

Mr. MASTERSON. I would like to say a word with regard to the number of deaths from typhoid fever. I have been living in our town all my life, and there have been only about two or three deaths from typhoid in that time. I had a conversation with our medical health officer a year or two ago, and he told me that in his practice of over 30 years he had had an average of 11 cases of typhoid and only 3 deaths, and, of course, that includes a part of the township of Niagara. I do not mean to say that is all on account of the purity of the water supply. I think it is to be attributed more to the skill of the doctors—we have been blessed with very good doctors.

The information that the mayor has given you I think pretty fully covers our case. I was in touch with the gentlemen who were conducting the investigation last year relative to the pollution of the waters, and they told me that the water was very bad for a good many miles out into the lake.

I was interested in some remarks here a while ago about the mixing of the water and the purifying of it. That is all tommyrot, in my estimation, because it is pretty thoroughly mixed when it goes through the lower rapids here, and the statistics show that from side to side at our end of the river the water is absolutely impure at every point; and there are two points—our town and the town of Youngstown—that are using the water. We are up against the proposition of securing pure water for our people. A great many of our people depend upon the reputation of the town for pure water, just as Niagara Falls does. We are told by our medical health officer that our people must be, to some extent at least, immune from typhoid on account of always using this water. There may be some truth in that, but at the same time they tell us that the people who come from

other points and use the water are likely to contract typhoid fever and go away and die from it. So that any step that you gentlemen can take in the way of purifying the water before it comes to us will be appreciated by a great many people. We entertain people from Toronto and other places a great distance away, and it is very vital that we should be able to give them a pure water.

STATEMENT OF MR. WILLIS CHIPMAN, OF WELLAND, ONTARIO.

The CHAIRMAN. Mr. Chipman, will you please tell us what you know about the locality of Welland?

Mr. CHIPMAN. I was called in a few days ago to look into this matter. I expected to be able to introduce to you another gentleman who on account of illness has not been able to be present. I am not as familiar with some of the details as the municipal counselor or the mayor or the solicitor.

The CHAIRMAN. Do you live in Welland?

Mr. CHIPMAN. No; I live in Toronto.

The CHAIRMAN. Do you know what the population of Welland is?

Mr. CHIPMAN. It is between 7,000 and 8,000.

The CHAIRMAN. What system of drainage have they?

Mr. CHIPMAN. I designed a system for them some years ago, which system has since been constructed. At that time they contemplated putting in sewage-disposal works when they could afford it or when the quantity or volume of sewage would warrant it.

The CHAIRMAN. Will you kindly describe the system that is in operation now? Before you proceed with the description of the system, however, will you please tell the commission what experience you have had in these matters? I believe you have been a sanitary engineer for a long while, and you have had a great deal of experience in the matter of drainage. Is that true?

Mr. CHIPMAN. I have been at it since early in the eighties—30 years ago.

The CHAIRMAN. You have devised or planned a great many of the sewerage systems in Ontario, have you not?

Mr. CHIPMAN. Quite a number; not only in Ontario, but also in Manitoba, Saskatchewan, and Alberta.

The CHAIRMAN. Now, will you please proceed with the description of the system that is at present in operation?

Mr. J. F. GROSS. I might say in behalf of the town that, knowing Mr. Chipman's experience, we called upon him to solve as nearly as he could this problem for us. That is the reason I am putting him forward.

Mr. CHIPMAN. Here is a general plan of the town showing the sewerage system as designed.

The CHAIRMAN. I suppose you can leave these blue prints with us?

Mr. CHIPMAN. These I can leave with you.

Mr. POWELL. Does that show the disposal of the sewage?

Mr. CHIPMAN. No; this print shows the sewage-disposal works, which are marked at two points.

The CHAIRMAN. Just describe this plan.

Mr. CHIPMAN. The town is in rather a flat country, through which passes the Welland Canal as it exists to-day and the Welland River,

the river passing under the canal through a culvert. The river is from 8 to 10 feet lower than the canal. That divides the town into three sections. It is almost impossible to get sewage from one to another. I propose to construct the sewage-disposal works for the east side——

The CHAIRMAN. Before you go into that tell us what these heavy white lines are.

Mr. CHIPMAN. Those were the boundaries of the town, I think, at that time.

The CHAIRMAN. I mean the regular lines inside of the boundary.

Mr. CHIPMAN. They indicate the drainage area that could be drained into this system. There is a section here that is out in the country that is all farm land.

The CHAIRMAN. Is there anything on this plan to show how the town is drained at the present time?

Mr. CHIPMAN. Yes.

The CHAIRMAN. How do you indicate the drains?

Mr. CHIPMAN. Here they are [indicating]. All of these are sewers. This is the main sewer [indicating]. I shall give you another blue print showing them. Some of these are built and some are not.

The CHAIRMAN. Then this blue print represents your project?

Mr. CHIPMAN. My project.

The CHAIRMAN. Now, have you another plan which shows how far this project of yours was carried out?

Mr. CHIPMAN. Yes.

Mr. GROSS. The Welland Canal shown on the plan is the same Welland Canal that I presume the Niagara Falls people referred to?

The CHAIRMAN. Yes.

Mr. CHIPMAN. This is on a much smaller scale.

The CHAIRMAN. The first blue print, which is called "The topographical plan of the town of Welland, 1907," we will designate as "Exhibit A"; and this smaller blue print, which is called "A general sewer plan of the town of Welland," we will designate as "Exhibit B." Mr. Chipman, will you explain this Exhibit B and tell us what it indicates?

Mr. CHIPMAN. Plan "B" indicates the sewerage system as it is built to-day.

The CHAIRMAN. How is the sewerage system indicated on this plan?

Mr. CHIPMAN. It is indicated by lines in the center of the streets, which also show the diameters of the sewers and the points of outlet.

The CHAIRMAN. I see some dotted lines here in the middle of some streets. What do those lines indicate?

Mr. CHIPMAN. They are not built yet.

The CHAIRMAN. They are proposed sewers?

Mr. CHIPMAN. Yes; connecting with these that are built—extensions.

The CHAIRMAN. Now, please explain your project. Did you say that there were three divisions?

Mr. CHIPMAN. The water divides the town into three sections or districts. Each section has its separate system of sewers.

The CHAIRMAN. But what is that system? Explain that.

Mr. CHIPMAN. It is the combined system of sewers in which the storm waters and the sanitary or domestic waters enter the same pipes.

The CHAIRMAN. Where does the sewage go?

Mr. CHIPMAN. All of it flows into the Welland River. It can not flow into the Welland Canal, which is too high.

The CHAIRMAN. The town of Welland allows all of its sewage to go into the Welland River?

Mr. CHIPMAN. Yes, sir.

The CHAIRMAN. I thought you spoke of tanks which you proposed to build?

Mr. CHIPMAN. They have not been built.

The CHAIRMAN. But they were in your plan?

Mr. CHIPMAN. They were projected.

The CHAIRMAN. Please explain them.

Mr. CHIPMAN. The reason for not carrying that out is the prospect for the new canal. It has been in prospect for a number of years. They did not feel like going to any expense until they knew what the Dominion authorities propose, and it is not settled yet what they are going to do.

The CHAIRMAN. How would that change the system?

Mr. CHIPMAN. Their latest project is to raise the Welland River to the same height as the Welland Canal and create a large flood tract of land west of the town, utilizing the Welland River as their canal, which would destroy our sewer outlet entirely.

Mr. MAGRATH. When you speak of "their latest project," you mean the Dominion Government?

Mr. CHIPMAN. Yes.

The CHAIRMAN. What was the system of tanks?

Mr. CHIPMAN. Simply sedimentation tanks for the present. It was a tentative scheme. It was so understood by the council and, I think, by the health authorities.

The CHAIRMAN. I do not understand why any new plan as indicated by you and the Dominion Government would change the system that you had projected of having sedimentation tanks.

Mr. CHIPMAN. Our tanks were of such elevation that the effluent could be discharged into the river. Now the river is to be raised about 10 feet, and if constructed they would drown those tanks out.

Mr. GLENN. Where do you get your drinking water?

Mr. CHIPMAN. From the canal, and there is no typhoid to amount to anything.

Mr. GLENN. Do you empty into the river?

Mr. CHIPMAN. We empty into the river.

Mr. GLENN. How far above here do you get your water?

Mr. CHIPMAN. We get it from below.

Mr. POWELL. That is, you tap the canal in the center of the city?

Mr. CHIPMAN. Yes.

Mr. POWELL. Where does the canal have its point of departure from the river?

Mr. CHIPMAN. It has no connection with the river, except with the lock.

Mr. POWELL. But at what point in the Niagara River does the water come from that goes through the canal?

Mr. CHIPMAN. It comes from Lake Erie, at Port Colborne.

Mr. GLENN. Where does it flow into the Niagara River?

Mr. CHIPMAN. It does not. The Welland Canal flows in at Chipewa.

The CHAIRMAN. How far above the mouth of the Niagara River is Port Colborne?

Mr. GROSS. It is 8 miles.

The CHAIRMAN. The town of Welland would not get any of the pollution coming from Buffalo, then?

Mr. CHIPMAN. No.

The CHAIRMAN. You do not complain of that at all?

Mr. CHIPMAN. No; it is the navigation pollution.

The CHAIRMAN. So that the town of Welland gets comparatively pure water, but you pollute the water.

Mr. CHIPMAN. Not the canal.

The CHAIRMAN. But you pollute the river.

Mr. GROSS. That is correct.

Mr. CHIPMAN. I do not think we pretend to deny that.

Mr. MAGRATH. Does this plan contemplate any improvement in the existing situation?

Mr. CHIPMAN. I think perhaps Mr. Gross can explain that better than I. We are not in any position to say.

Mr. GROSS. The Government proposes using the river for the canal in connection with the Welland Ship Canal. If they do so, our water supply will be destroyed as well as our sewerage, because the canal will be raised to such a height that we can not sewer into it without pumping. The water now is comparatively pure. We do chlorinate a little, but our water is good and we have no typhoid. If the Welland River, which comes from above, is turned into the canal, it will make the canal one large sewer where the canal is now a pure lake stream. We do not know what is going to be done about it.

Mr. GLENN. When you empty your sewage into the river do you do anything to it to purify it?

Mr. GROSS. No; it is raw, but we are disposed to put in whatever is recommended. The system is designed with that end in view, but we have been served with notice that the river is going to be made a canal and they will not allow any sewage to go into it; so what we are to do I do not know.

The CHAIRMAN. They will not allow any sewage to go into it?

Mr. GROSS. The Government proposes building a dam across the Welland River at Port Robinson, about 4 miles north of Welland, and using the 4 miles of river between the town of Welland and the village of Port Robinson as part of the canal system.

The CHAIRMAN. Was it not a part of that plan to bring the pure water down in a pipe?

Mr. GROSS. Yes; I shall come to that in a minute.

The CHAIRMAN. Your only complaint is that you would not be allowed to pollute the canal water?

Mr. GROSS. That is a question for Mr. Chipman. Our sewerage system will not go anywhere. The cellars will back up and the whole thing will be stopped by the construction of the canal as it is proposed to construct it. We say that the river, being a natural stream just as God made it, should be left alone, and that it is not an engineering impossibility to take a canal over it now as they did 75

years ago. That river goes away up, it is flooding an immense territory, and there will be continual trouble. The people of the town of Welland say they should take it over the river, leaving the canal water pure. We will put in our works for the reduction of the sewage, the treatment of the sewage, and do whatever is necessary.

The CHAIRMAN. The town of Welland will be willing to do anything that is reasonable in the way of treating the sewage and preventing its going into and polluting the waters of the Niagara River?

Mr. GROSS. Yes. The town does not want the Government to interfere with that river.

Mr. GLENN. What do they claim that they gain by turning that river into the canal?

Mr. GROSS. I would rather have Mr. Chipman answer that question.

Mr. CHIPMAN. I must ask the Government's engineer to explain that; I can not.

Mr. GROSS. I can tell you what there is now. There is an immense aqueduct built of masonry with five arches under it. The Welland Canal there is probably 200 feet wide, and at ordinary level the canal is 10 feet above the river. Then there is just a stone bridge put across that carries the canal, and there are arches that do not show above the water, but they are down there—that take the river under it. It is, of course, a navigable stream, and to provide for that there are locks at Port Robinson. Probably we Welland people are wrong, but we want them to build another one of those. The present canal has 15 feet of water. The new canal is to have 25 feet, being about 10 feet deeper than the present canal. The Government engineers say they can not design anything that will take this canal over the river; that they prefer spending a million dollars for a pure-water system, but they have not as yet said anything about the sewage. Thorold, Merritton, and the city of St. Catharines all take their water from the Welland Canal, and their proposition is that the Government construct a pipe from Lake Erie along the canal on the money expended for the construction of which the municipalities are to pay interest. That is being provided for; but there is nothing yet that I have heard of as to whether the new Welland Canal is to be a sewer in the nature of the Welland River—for which I suppose the people of Niagara Falls will be glad—but it seems to us that to turn the Welland River, which drains marshy land, into the Welland Canal is taking a retrograde step.

The CHAIRMAN. Where do these towns of Merritton, Thorold, and St. Catharines drain?

Mr. GROSS. They all drain into the valleys.

The CHAIRMAN. And not into the Welland Canal at all?

Mr. GROSS. No. The Welland Canal drains the height of land between Lake Erie, and the land rises above Lake Erie through Pelham.

The CHAIRMAN. What other towns or cities does the Welland River drain except Welland?

Mr. GROSS. None.

The CHAIRMAN. In that regard you are the only offenders, then?

Mr. GROSS. Yes. It is quite a large river, and we want to do what is just and right, but we were between the devil and the deep sea.

The CHAIRMAN. The devil being the Dominion Government?

Mr. GROSS. Yes. It has been suggested that the Government should make a large sewer from Welland to Port Robinson. If they do that, it will not help our good friends at Niagara Falls any. The Welland River is a very peculiar stream. There is no current through it except during freshets. It is dead. You can take a motor launch and go right up to this aqueduct across it. Ordinarily there is no current either way. The level of the Welland River at Welland is according to the Niagara River.

Mr. GLENN. Is there any probability of that channel being changed?

Mr. GROSS. They are working on it now.

Mr. GLENN. So it is going to be changed?

Mr. GROSS. Yes.

Mr. GLENN. And you can not do anything until you know what they are going to do?

Mr. GROSS. No; we do not know what is going to be done. They are going to decide about the water problem. If they decide to make a part of this Welland River a part of the canal, it will flood a highway for 30 miles above Welland; it will raise it that many feet.

The CHAIRMAN. I understand that the work on this new canal is considerably advanced?

Mr. GROSS. You understand that the new canal from Port Robinson to a little village called Landbridge is dead level. North of that are the locks.

The CHAIRMAN. How long would it be in the ordinary course of events before the Dominion Government would have to come to some decision as to the point which you raise?

Mr. GROSS. They must decide very shortly. They can not let any more contracts until they do.

The CHAIRMAN. So it is a matter that will have to be decided within a very short time?

Mr. GROSS. Yes. That is why the whole matter is in the clouds.

The CHAIRMAN. It is absolutely necessary, before you back any decision as to the proper plan for draining this city, that the Dominion Government come to some definite policy as to what they are going to do with the Welland Canal?

Mr. GROSS. Yes, sir; until then we can do nothing. They have filed some plans, but there is nothing definite about it.

The CHAIRMAN. If they do turn this river into the canal, you do not say it would be impossible to dispose of the sewage of Welland?

Mr. GROSS. All sewage would have to be pumped to some high ground or to the lower river. There is no outlet whatever.

Mr. GLENN. There is no way of getting it into the canal without pumping it there?

Mr. GROSS. There is no possible way. Of course, we can pump it into the canal. That is one of the points upon which I have not yet heard what the decision is, whether the canal is to be kept reasonably pure or whether it is to be used as a sewage outlet.

The CHAIRMAN. But you would have to treat your sewage as some of the inland cities of the old country treat theirs.

Mr. GROSS. The sewage from all these towns should be treated. The new work for the town of Thorold will go through our supply

reservoir and cut off about a third of it. We have been told by the engineers that we need not worry over it for some years.

Mr. POWELL. What is the length of the channel of the Welland River?

Mr. GROSS. It must be about 15 miles from Welland to the Niagara.

Mr. GLENN. If you purify your sewage there could be no objection to your dumping it into the canal, would there?

Mr. GROSS. No; if it is not used as a water supply below.

Mr. GLENN. Even though it were, if you purified it to a great extent it would not hurt, would it?

Mr. GROSS. I prefer not to put sewage into a stream out of which I drink water, whether I purify it or not.

Dr. McLAUGHLIN. May I ask if this project of turning the Welland River into the canal, if carried out, would eliminate the Welland River as a tributary of the Niagara? Would it take the entire flow of the Welland River?

Mr. GROSS. No. It would at this time of the year, because there is no flow in it. In the freshet season they would provide for the overflow into the old channel. There is a proposition before these towns from the Dominion Government for supplying them with water, but I have not seen it except as it appeared in the newspapers.

The CHAIRMAN. Supplying them with water?

Mr. GROSS. Yes; but that affects the question of sewage. It may be that if the canal is to be retained for the water, the sewage must be dealt with in some other way.

Mr. GLENN. They would not have a canal for the purpose of destroying your river and still give you no outlet at all for your sewage, would they?

Mr. GROSS. They have not told us what we can do or what they are going to do.

Mr. GLENN. I thought you said they were preparing pipes to bring you purer water?

Mr. GROSS. That is one of the projects, costing a million dollars, which will double the cost of the water system in all these towns. Their operating expenses will be two or three times what they are to-day, and they are not prepared as yet to accept them. At least, that is true, so far as the town that I represent is concerned. We want to have time to look into it.

Mr. POWELL. In other words, the two schemes are, first, to utilize the new canal as a water-supply system, and second, to utilize that as a sewage-discharge system and have an independent water supply?

Mr. GROSS. That is the idea. They have not come to any conclusion as yet.

Mr. GLENN. We can not suspend our report until you people decide what you are going to do. What is the effect of sewage being poured by your town into the Niagara River? What effect does it have on the towns below you?

Mr. GROSS. That has all been investigated and reported upon. I have seen the polluted water from the Niagara River more than a third of the way over to Toronto.

The CHAIRMAN. You are a sanitary engineer, but you are not a sanitarian?

Mr. GROSS. Exactly.

Mr. POWELL. Mr. Chipman, what is the estimated cost of your proposed scheme of purification of the sewage at Welland, your old scheme?

Mr. CHIPMAN. We were proposing only two tanks, at a probable cost of \$25,000.

Mr. POWELL. With sedimentation?

Mr. CHIPMAN. Yes; at that time.

The CHAIRMAN. That would have been sufficient.

Mr. CHIPMAN. It would assist. The more organic matter you can get out of the sewage, of course, the less there is that goes into the river.

Mr. POWELL. You did not propose to supplement it in any way?

Mr. CHIPMAN. Later on.

Mr. POWELL. If you were called upon to do it?

Mr. CHIPMAN. If we were called upon to do it.

The CHAIRMAN. Is Welland a growing town?

Mr. CHIPMAN. It has doubled its population in the last five or six years.

Mr. GLENN. What is its population now?

Mr. CHIPMAN. About 8,000.

STATEMENT OF MR. JOHN GOODWIN, MAYOR OF WELLAND, ONTARIO.

Mr. GOODWIN. Mr. Chairman, I just wanted to refer to a matter that Mr. Gross brought up. It was proposed to extend a large trunk sewer along the Welland River to Port Robinson. We suggested that to the minister, Mr. Cochrane, a couple of months ago while he was in Welland dealing with this matter. To begin with, the Government has a large sewer that drains into the Welland River which we are allowed to use or have been given permission to sewer into. It was suggested to them that, owing to the fact that the raising of the river to the height of the canal would merge this trunk sewer, it be inclosed the entire distance to Port Robinson, and then instead of having to install the different treating systems at the mouth of each sewer, as Mr. Chipman proposed, we would have only one outlet for this sewage and that we would treat it at Port Robinson before entering into the Niagara River.

Mr. GROSS. What did he think of it?

Mr. GOODWIN. He did not take to it very kindly. He thought it would be too great an undertaking for the Government.

The CHAIRMAN. Is there anybody else here who wishes to speak on behalf of Welland?

Mr. GROSS. That is all unless there is some further information that we can give you.

The CHAIRMAN. Our secretaries are going to ask you for some statistics, which I have no doubt you can furnish.

Mr. GLENN. I understand you are here to tell us that you are putting sewage into the river, and that you are willing to protect it, but that you do not know how to go about it?

Mr. GROSS. Yes. We have the Ontario government and its officers instructing us what to do, and then the Dominion authorities, who have absolute control, can tell us what they are going to do or may

do. We are willing to do anything that the duly constituted authorities instruct us to do.

Mr. GLENN. In the meantime what must we do in regard to your putting that sewage into the Niagara River?

Mr. GROSS. Buffalo has a half million people, and the town of Welland has 8,000 people. We should be blamed only for about one-eight-thousandth of this trouble. But whatever is right and can be done I think the people of the town of Welland will do. We have been spending immense sums. It used to be that the workingman could go outdoors and did not require the ordinary accommodations, but now every workingman in our country wants his bathtub like anyone else, and the question of sewage must be met. It will probably be beyond our tax rate. We are levying now all that the law allows us.

Mr. GLENN. I understood the gentlemen from Niagara Falls, Ontario, to say that they did not think they got very much sewage from Buffalo unless the wind drove it across, but they thought they got most of it from the Welland River. As you said you were the only city of any size, I thought they must get it from you.

Mr. GROSS. They are like us. They dump theirs in raw down below. We are all in the same boat. We dare not start putting in works, even if the provincial board orders us to, because they are not the boss; it is the Dominion Government. There is another point: There is the greatest cranberry marsh up there. The Welland River is the natural drainage of the cranberry marsh. The town of Welland is approximately 20 feet above the Welland River. If the Welland River is raised it is going to be to us a much more serious matter. If it were only a question of putting in these tanks I think we could bond ourselves for money enough to do it, but I do not see how anything can intelligently be done until this whole matter is thrashed out.

Mr. GOODWIN. The sewage of Welland has to travel 15 miles before it reaches the Niagara River.

Mr. POWELL. What is your public debt?

Mr. GOODWIN. Our public debt is in the neighborhood of about \$1,000,000, is it not?

Mr. GROSS. Not that much. It is \$880,000 for a population of 8,000.

The CHAIRMAN. Well, that will be given to us with the statistics that will be called for by the secretaries of the commission.

Mr. TAWNEY. What is the assessed valuation of property?

Mr. GOODWIN. \$4,185,000.

Mr. MAGRATH. What is your rate?

Mr. GOODWIN. 27½ mills. It ought to have been 30 to carry us through.

Mr. POWELL. Is that all your rate—about 30 mills?

Mr. GOODWIN. Yes.

Mr. GLENN. Are you assessed pretty high or pretty low?

Mr. GOODWIN. Quite high.

The CHAIRMAN. Is there any other city, town, or village which is represented here that would like to be heard?

Mr. TAWNEY. Mr. Burpee, what towns were notified that have not appeared?

Mr. BURPEE. Fort Erie, Queenstown, Grimsby, Port Dalhousie, and St. Catharines, and the townships of Grimsby south, Niagara, Bertie, Crowland, and Willoughby.

The CHAIRMAN. If there is no one else here representing any city or town that would like to be heard, the commission will now adjourn. We are very much obliged to you gentlemen who came here to assist us in the important work that we have to do, and I have no doubt the information that we have received here this morning will be very helpful to us. We shall be very glad to see any of you gentlemen at Buffalo to-morrow and Monday, where the commission will meet in room 209 of the Federal building and continue the investigation.

Mr. A. MONRO GRIER, K. C. I am quite convinced that what I shall now say is absolutely in the hearts of all of us who are here, and that is that we are very glad to see the commission here and hope it will find itself here frequently; and, Mr. Chairman, that is extended not only to you and your compatriots but also to the other members from the other side.

(Thereupon the commission, at 12.40 o'clock p. m., adjourned to meet in Buffalo, N. Y., September 26, 1914.)

INTERNATIONAL JOINT COMMISSION,
Buffalo, N. Y., Saturday, September 26, 1914.

The International Joint Commission met at Buffalo, N. Y., on Saturday, September 26, 1914, in pursuance of the consideration of the reference in relation to the pollution of boundary waters.

Present: Canada—T. Chase Casgrain, K. C. (chairman), Henry A. Powell, K. C., Charles A. Magrath, Lawrence J. Burpee (secretary). United States—James A. Tawney (chairman), Obadiah Gardner, R. B. Glenn, Whitehead Kluttz (secretary).

APPEARANCES.

Dominion Government: Dr. Montizambert, C. M. G., superintendent general of public health.

United States Government: Dr. Allan J. McLaughlin, of United States Public Health Service, and Prof. Earle B. Phelps.

Province of Ontario: Mr. F. A. Dailyn, representing provincial board of health, and Dr. John Amyot; Theodore Horton, chief engineer State board of health, Albany, N. Y.

Municipalities represented: City of Buffalo—George H. Norton, deputy engineer, commissioner of the city of Buffalo; A. W. Holloway, representing the city council; Dr. Francis E. Fronczak, health officer of the city of Buffalo. Tonawanda—John A. Rafter, mayor of North Tonawanda; W. G. Palmer, member of public works board, North Tonawanda; William A. Moore, North Tonawanda; Robert J. Cordes, South Tonawanda; Charles Tuckmeyer, South Tonawanda. Niagara Falls, N. Y.—F. S. Parkhurst, jr., city engineer; F. G. Anderson, corporation counsel. Lockport—Rev. George A. Brock, mayor of Lockport.

Mr. TAWNEY (chairman of the American section of the commission). I do not know that it is necessary for me to make any statement concerning the purpose of the International Joint Commission in coming to Buffalo on this occasion, as the mayor of your city and others who are interested in the public health have been advised by letter of this meeting and also of the object of it. You are all aware of the fact that under the treaty of the 11th of January, 1909, the Governments of the United States and of the Dominion of Canada have referred to this commission two questions with respect to the pollution of the waters that mark the boundary between Canada and the United States. One of these questions is the facts and extent of the pollution, and the other is the remedy for the pollution found to exist. The commission has concluded its investigation on the first branch of the reference, namely, as to the fact and extent of pollution. As a result of the investigation of that branch of the reference, we find that these boundary waters are polluted more or less from the Lake of the Woods on the west to the St. John River on the east, a distance of almost 2,000 miles. Before concluding our investigation and making our final report to the two Governments, with our conclusions and recommendations on the subject, the commission decided to hold public hearings at all of the principal cities situated upon these boundary waters, for the purpose of ascertaining what these municipalities are willing to do and what they are capable of doing in the way of installing and maintaining plants for the purpose either of purifying the water or treating their sewage. The necessity for this course grows out of the fact that when the treaty of January 11, 1909, was prepared and signed by the representatives of the Governments of the United States and of Great Britain they agreed in the last paragraph of Article IV that neither country would permit the pollution of these waters that mark the boundary between the two countries to the injury of health or property of the other.

It having been ascertained that these waters are being polluted in violation of this provision of the treaty, and complaints having come to both Governments to that effect, it is necessary for the two Governments to find some remedy that will prevent the violation of this solemn agreement between them, and for that purpose they have referred the matter to the International Joint Commission, under Article IX of the treaty, not for a decision, however, but merely for a report of our conclusions and recommendations. It is the desire of the commission to have our conclusions and recommendations conform as nearly as may be to the sentiment of the people on both sides of the line with respect to what they can or are willing to do to aid both Governments in the observance hereafter of this provision of the treaty. Notices of this meeting were sent to the mayors of adjoining cities and to the mayor of the city of Buffalo, together with copies of our progress report on the first branch of the reference, and also the testimony of sanitary engineers, taken by the commission in New York City last May, with the résumé of their testimony and their opinions as to what remedies are necessary in order to protect the public health along these boundary waters.

As some of you may know from examining the progress report, notwithstanding the favorable climatic conditions and the absence

of that density of population which exists in large cities in other countries, the prevalence of typhoid fever and the death rate from that disease in many of the cities along these boundary waters is greater than in any city on this continent, which is attributed by scientists almost wholly to the existing pollution of these waters from the use of the rivers connecting the Great Lakes by these cities as sewers.

The object of our meeting this morning is to hear the officials of the city of Buffalo and the surrounding cities on the Niagara frontier, who are to a greater or a less extent offenders in this matter, as to what they are prepared and willing to do in the way of remedying the evil that now exists.

The commission does not propose to impose on any of the cities any burden that they can not reasonably bear in order to bring about the remedies necessary, but in whatever is done the commission desires that it should have the cooperation of these cities that are now polluting these waters by the discharge of their sewage untreated or otherwise into the connecting rivers. If the mayor of the city of Buffalo is here, or anyone representing them, we would be glad to know who is present to speak for the city of Buffalo.

MR. A. R. HOLLOWAY. I am authorized by the committee of council to appear here. We are looking for information so far as our committee is concerned. Mr. Norton represents the committee on public works.

(The chairman then asked who represented the other cities notified, and the list was given as published above.)

MR. WILLIAM MOORE. The mayor of North Tonawanda has asked me to appear for the city, more especially as Mr. W. M. Mills, president of the Niagara Frontier Water Conference, is absent. Mr. Mills has devoted years to the question of pure water and is the best posted man on the subject.

MR. TAWNEY. My attention has been called to the fact that the local papers here have announced that this was a meeting of the United States section of the International Joint Commission. I want to correct that statement. It seems to be difficult to get the newspapers to understand that this is an international joint organization, composed of two sections, consisting of three citizens of the United States and three subjects of Great Britain representing Canada. No section of the commission has any authority or any power whatever, under the treaty, without the other section—the commission acts as a joint body. Each member is as much a representative of one country as of the other, regardless of his citizenship. The name of the commission is the International Joint Commission, and not the International Waterways Commission.

GEORGE H. NORTON (deputy engineer commissioner of the city of Buffalo). In the absence of the commissioner of public works, under the law I act as such, and during the recent temporary absence of the commissioner the mayor sent to the commissioner's office the correspondence in this matter, with the request that the commissioner should act. I expect the commissioner of public works here this morning. As the engineer of the city, having charge of the sewers, I had the honor of meeting your commission several times and of

consulting with your experts. I have gone over the reports which have been submitted. The time was rather short. There were transmitted last Monday extracts of the reports to the common council, with a recommendation that a committee be appointed to attend this meeting, consisting of members of the council, the mayor, the health commissioner, and the commissioner of public works. Mr. Holloway is here representing the common council, and the health commissioner will be here. Officially for the city of Buffalo I have nothing to say, but as the engineer officer I have prepared a statement for the information of the commission and for submission to this commission. It represents simply my views as an engineer, and I suppose even some of those will be subject to question by your sanitary experts. I believe there is no objection on the part of the city, and I would submit the statement and read it if you wish.

Mr. TAWNEY. We will be very glad to hear you.

Mr. NORTON. Since getting the report from the mayor I have not had time, perhaps, to consider the matter as it deserves, but this is the statement which I wish to present:

A. This city extends its appreciation to this commission for the great work done in its research upon the condition of these boundary waters. This report verifies and substantiates the belief of those who have given the matter serious consideration—that the great central body of these Lakes is pure and apparently is destined to so remain if no material further burden is placed upon these waters. The opinion of some has inclined to a fear that there was a growing pollution of the whole body of water beyond its power of self-cleansing.

B. There can be no general dissent from the findings of the consulting sanitary engineers. Their testimony and findings set forth the broad aspects in a most satisfactory manner and furnishes the sound judgment upon which the solution of this great problem must rest.

C. Before passing to detailed considerations a few minor points are noted. In the "tentative plan for conduct of investigation of second brand, etc.," under No. 3 it is proposed that all cities should file plans with Federal authority. To this there can be no objection. However, the further provision "if extensions or alterations are desired application (with full description and plans in quadruplicate) should be made to the said Federal authority for permission," and that no work should be done until permit is granted, has objections. Often in development of new property divisions the owners consider themselves aggrieved even at the short delay in preparing plans and for operation of the municipal machinery where the same is under immediate contact. We see no reason why such provision should be made, as it can accomplish no benefit. Where changes are to be made in the discharge into the public waters or changes to be made in method or quality of discharge or in method or appliances for treatment, then such might reasonably be under some control, but when outlets and their adjuncts are established they are planned to care for some definite territory and its gradual development, and the execution of interior details are but completing the function of the outlet. This point is well covered by the testimony of Mr. Dallyn, who is in a position to see the unwisdom of a burden of needless detail.

On page 47 of the report of conference with sanitary engineers Commissioner Powell speaks of experts in the case of Buffalo as prescribing settling tanks or screening. It may be well to clear the record on this point. Buffalo has had no report upon this condition from any outside source. There was presented to you at a former hearing a copy of report made by a competent expert upon the availability of certain lands for sewage treatment. As I am informed, this report was made to a purchaser or prospective purchaser of certain lands, as to their potential value for such purpose. The city had no part or interest in this investigation or report. Further mention is made in the progress report that the city might submit a statement from Rudolph Hering. This was not contemplated. Dr. Hering, who is familiar with conditions in this city, conferred for a short time with the commissioner of public works upon the larger aspects of the situation, but no report was requested or made.

D. The large question before us is that contained in your letter of August 20, 1914, No. 2—"What remedies they would advise and are capable of installing and maintaining."

To properly answer the first part of this question as to what we would advise, it may be noted that your commission wisely deemed necessary, first, an exhaustive study of conditions, and, after, the advice of the sanitary engineers.

Reports covering these two phases have been before us but a few short weeks at our busiest season, and but a partial digestion of these reports has been possible. It is assumed that some definite plan might be expected under your invitation which would embody our interpretation of reasonable action under these premises. It, however, appears to us that the shortness of time alone offers a reasonable excuse for nonpresentation of any definite proposals.

There is another phase which also is before us; public sentiment as well as sanitary knowledge has well established the approaching necessity of some action in this matter.

Under conditions which might become of grave financial moment to this city, it seemed most wise to await the full development of fact and conclusions under which uniform and acceptable action should be taken. The reports already submitted go far toward establishing a sound foundation.

I would note from the testimony of Dr. Phelps, "it seems to me that it is the commission's duty to offer the cities some tentative program on which they are to be heard, rather than to ask them what they are going to do," and of Mr. Whipple, "but I have a feeling that, as Prof. Phelps said, it would be well for you to formulate some definite policy beforehand."

These conditions have been largely met in the résumé of the testimony of the consulting sanitary engineers. I am not prepared to say that this city desires the submission of a plan by your commission, but a general discussion now may clear the path for future action.

For our information the question is asked: Is it expected to make the findings of this commission effective by executive order of this commission or executive order of the parties to the treaty, or to invoke legislative authority based on your findings?

E. This city has heretofore objected to proposed action affecting our sewage without coincident consideration of water supply, which subjects you have so wisely combined. We are peculiarly dependent on their joint consideration.

To first note the relations of this subject to our own water supply, it is, as above stated, most gratifying to find the Buffalo supply in such excellent condition at time of examination. At such time we had the best, or one of the best, natural water supplies upon the boundary waters under your investigation. This has been substantiated by use, taking typhoid fever as a measure. The new intake at the head of Niagara River was first used in January, 1912. To August 1, 1914, 31 months' time, with partial but decreasing use of our old intake during part of the time, our typhoid death rate has decreased from an average of about 26 to 12.9 per hundred thousand. This rate compares most favorably with many cities having a most satisfactory natural or even filtered supply. A diagram is submitted herewith copied from your figure 27, page 355, progress report, to which is added the Buffalo rate for the past 31 months.

Inspection shows that we, as a northern city and under the excellent endeavors of our health commissioner, are unusually free from the seasonal or autumn typhoid. There remain two periods of unsatisfactory typhoid prevalence which we may reasonably assume as water borne. Their existence is assumed as an index of occasional unsatisfactory waters. The spring increase is quite as marked as that of winter. It occurs without gales or roily condition. Three possible explanations have been considered—change of maximum density causing complete transfusion of water; influx of surface drainage; ice pollution.

There is undoubtedly a complete turn over of the whole body of water at time of water reaching its maximum density of 39° F. in the early winter, but such is coincident with the season of gales. The reverse change would be less marked, but might reasonably bring up a concentration of occasional or minute pollution which has accumulated during the season of minimum beneficial bacterial action.

The influx of surface drainage which raised the surface elevation of Lake Erie as much as 1½ feet in a month in the spring of 1913 would represent the addition of about 2½ per cent of its total volume in contaminated surface drainage, but, as followed so soon after by your exhaustive examination, it apparently had no effect on the central body of water. The third or ice factor

seems to have more weight. Not only is much of the shore ice formed in contaminated waters, but material additions are made to such by all entering streams. Prevailing southwesterly spring winds hold the ice at this end of the lake, where it is surface washed, but much of it passes down the Niagara River, and, if a menace, is equally so to all users of this river water. Buffalo and the Niagara frontier cities are more exposed to this possible source of pollution than other cities upon the boundary. This spring typhoid has long been marked in Buffalo, and is believed to be noticeable in other cities of this climate and similar conditions. It is to be regretted that its real cause has not had more detailed study.

The prevalence of winter contamination must be associated here with the autumnal gales. The whole body of Lake Erie for many miles is thoroughly disturbed and the water exceedingly roily. This condition of rolliness does not alone account for contamination. Dr. McLaughlin, in his most excellent study of these conditions, puts forth the explanation that in severe storms the undertow from our harbor front carried out polluted water. This hypothesis has seemed reasonable to me, but further study has materially weakened my belief in its full force. If we add to the great vessel traffic of Buffalo and the Niagara the large passenger and excursion business passing over these shoal waters in this vicinity and consider that a material part of the larger fecal matter must be here deposited, we must expect that storms at the end of the season of navigation, which stir up this sediment from the lake bottom, will bring with it much of that which originates from vessel pollution. That the general effect of even 30 days of this condition in a season is not materially greater than our spring pollution seems a reasonable argument that no great quantities of the highly polluted harbor waters are carried to our intake. If this argument is even reasonable, it is of the strongest against vessel pollution.

As our typhoid death rate of 12.9 for two and one-half years compares most favorably with the average of 15.1 for the cities of Philadelphia, Pittsburgh, Cincinnati, New Orleans, Washington, Minneapolis, Indianapolis, Providence, Louisville, and Columbus for 1912, all enjoying filtration with some added sterilization, our position does not seem alarming. A complete liquid chlorination plant was placed in use upon our new intake on August 27, but sufficient time has not elapsed to note results. If such be in accordance with reasonable expectations, our position may be deemed reasonably secure, possibly excepting the period of maximum turbidity. At such times it may be that the turbidity will demand application of chlorine in excess of its advisable use. Certainly this turbidity should be removed, but its removal can not be deemed as a pressing measure for the public health.

My personal opinion is, therefore, that Buffalo may reasonably provide means for removal of autumnal turbidity and might also equip its old intake for chlorination should its occasional use be found advisable.

With such provision this city would be in possession of an inexhaustable supply of water in its raw state above the ordinary filter effluent, protected by complete chlorination and assured by duplicate intake and modern pumping plants of ample capacity. This is noted for subsequent reference.

For its protection we ask for reduction of pollution by vessels and a reasonable treatment of sewage by the city of Lackawanna.

F. The effects of our sewage discharge may well be first considered in its effect upon this city. Plans are now completed for certain interior changes which will prevent the discharge of sewage into our inner harbor, by diverting such discharge to our main outlet into Niagara River. This change is due to lack of capacity of a portion of an interceptor constructed by a former sewer commission.

A territory in the southwestern part of the city is without drainage. The land is low, indicating the desirability of a separate system. Our present plan is to carry sewage to a pumping plant and give such treatment as necessary to prevent nuisance when discharged into our outer harbor inside the Government breakwater. This should be designed to include future interception of several small sewers now entering Buffalo River and Cazenovia Creek when such require relief from nuisance. Our main outlets are so situated as to require but few changes to avoid reasonable complaint within our own bounds.

G. The effect of our raw-sewage discharge upon those below us involves two aspects—effect upon other cities of this State and effects crossing the boundary.

The effect of pollution in Lake Ontario from Niagara River pollution, while quite marked and extensive, appears to be to the serious inconvenience or detriment of very few. If its use for ultimate sewage destruction be con-

sidered a natural resource, its great function must outweigh in value any minute inconvenience. However, we must all agree that an extension of this condition is unwise and possibly dangerous.

A study of the condition of the lower Niagara River from Lewiston and Queenston to Lake Ontario shows that a reduction of 90 to 98 per cent or more of pollution would be necessary to bring these waters within the tentative limits suggested by the sanitary engineers as safe for filtration. No method of conservation of these waters as a natural resource for sewage dilution could be stretched to cover a 98 per cent reduction of bacteria, even with disinfection. If these waters are to be brought within the safe limit of load for water purification, apparently most thorough sewage treatment by all the river cities would be required and much more evidence produced to show that with the discharge of 50,000 second-feet of storm washings of western New York and adjacent Ontario, containing a rural and village population of over 100,000 we could conserve this as a potable water. The purchase of property and removal of the several adjacent villages by the upper river cities might be a less expense than the required degree of sewage treatment.

Niagara Falls has apparently taken such action in removal of its intake from the vicinity of its own as well as upstream pollution as assures a most reasonable raw supply and is amply treating such. Under the rule proposed there seems no unreasonable burden imposed upon them by upstream pollution. The same seems true as to Niagara Falls, Ontario, unless local shore pollution may be a factor requiring relocation of its intake.

As to the Tonawanda and Lockport supplies, there appear insufficient data. Observations made at one period of the year only can not assure that upriver pollution might not be excessive at some seasons. Neither is there assurance that the 50,000 second-feet of surface washings from Buffalo River and Tonawanda Creek might not impose an undue burden. In the absence of definite information we can but note average typhoid mortality statistics for these three cities for the past four years at 36.3, which is much below that under raw-water service in many cities which are apparently now well protected by filters.

A study of yearly variation for each of these cities may well raise suspicion of local causes outside general contamination, and a variation between rates of 15.5 for North Tonawanda and 66.9 for Lockport in the same year, where intakes are practically in the same thread of current, may strengthen the suspicion that the above rates are not entirely due to general pollution. At its worst, it might be reasonably assumed that a minimum treatment of Buffalo sewage would relieve these three cities of an unreasonable burden upon water-filtration plants.

It is unfortunate that three cities with a combined population of but 41,000 should have three distinct waterworks. These three plants combined in one could not only operate at a much less cost, but any combined filtration plant could afford that constant expert supervision beyond the reach of each of three separate plants.

H. From the above brief considerations, with limited study, my personal conclusions would therefore be that through a removal by Buffalo of a fair proportion of the solids of its sewage reasonable protection would be given to filtration plants for water supply of Tonawanda, North Tonawanda, and Lockport; that present conditions impose no unreasonable burden upon the water plant at Niagara Falls; that no appreciable burden is placed by Buffalo upon any communities or the waters of Ontario above Niagara Falls.

That the condition of the waters of the lower Niagara River are such that the burden could only be sufficiently removed by such extensive sewage treatment by all cities and communities adjacent to this river as would place an unbearable financial burden upon all.

That the pollution of Lake Ontario at the mouth of Niagara River is such as to demand the removal of a fair proportion of solids from the sewage discharge of all contributing cities and communities.

I. In consideration of any plan for sewage treatment by Buffalo it may be noted that available land values for even thorough sedimentation would be such as to make a perceptible initial investment. Lands outside the city could only be made available by pumping sewage. Where pumping and long conduits are involved there must reasonably be expected a corresponding reduction in relative quantity of storm sewage which would be so treated. Buffalo uses an unusually large quantity of water, and such use will not be materially re-

duced so long as an unlimited supply can be delivered at our most low rates, even after a moderate expense is incurred for clarification.

This present and probable water consumption in excess of that of cities enjoying a less liberal and excellent raw supply is a factor in determination of a method of treatment. Settling capacity must be a function of the volume of sewage, while screening capacity would depend to a material extent upon solids to be removed, so that if these two methods of clarification approximate an equality with normal and more concentrated sewage there would be an increased inclination toward fine screening, with increased dilution of sewage. Furthermore, fine screening seems to offer the opportunity for emergent treatment of a greater proportion of the storm sewage, which must comprise no small quantity of flushed sedimentation from our long and flat grade sewers.

While these considerations all point toward a certain treatment for clarification, it is with much hesitation that I have gone even so far, considering that these methods change so rapidly that many large plants designed along most approved lines are antiquated before completion.

K. The second part of your question, "What remedies they * * * are capable of installing and maintaining * * *," deserve a word.

This city is, like most others, in need of all its available funds to meet the increasing demands of modern life and living. The State constitution imposes a limit on indebtedness of 10 per cent of the assessed valuation. Exceptions to this have been made to all other of the larger cities in this State excepting one. This city may reach its debt limit before any action can be taken in this matter. Such limitations by removal of water-supply indebtedness from the included debt will undoubtedly be made for this city, but not within two years.

L. Some broad engineering phases of this subject may be pertinent, but those here noted are not offered by authority or suggested by public sentiment.

The sanitary functions of the Niagara River and its waters as a natural resource to be conserved for the benefit of its contiguous population are two: Supply of potable water and destruction of wastes or sewage.

Such use should be made as will accomplish these two objects at the total minimum expense without injury to others. This would not be accomplished by the expenditure of \$500,000 per year in purification of sewage above Niagara Falls to insure a potable water supply to 2,000 people along the river course below the Falls. A cost of \$250 per capita for these people might be warranted if it were the only possible supply. These lower-river communities have one natural resource of which they make no use—their location at a lower elevation which could supply all necessary pressure without pumping. Is it not most probable that Niagara Falls could supply this whole lower frontier from its satisfactory supply, by little or no pumpage, at rates comparable with the cost of individual local supplies pumped from the river by small plants? Could not such supply, almost by gravity, be furnished even to adjacent farms at no greater cost than by individual intakes and windmills or motors?

A similar thought can be applied to the upper river.

As previously noted, Buffalo is now in possession of a supply much above the average in its natural condition, protected by chlorination and equipped with modern duplicate supply plants. Even the addition of clarification will not bring the cost of the service above an unusually low rate.

The distance from our plants to those of the Tonawandas and the Lockport main is but 9 miles, 2 miles farther than to our own southwestern limits. Duplicate mains and local standpipes would give greater security than an isolated plant, and collection, sterilization, or clarification carried on in a great plant could certainly give greater insurance of quality.

The above suggested arrangements could minimize dangers from local pollution without vast expenditures for sewage treatment, so far as one side of the international boundary is affected. With the other side I am less familiar, but mutual cooperation under provincial or even international arrangement should not be beyond reason, considering that our own supply is now drawn from beyond this boundary line.

Such arrangements might not be without local friction, but such could be materially lubricated by a full view of dollars involved in the alternatives.

M. This somewhat extensive discussion does not present any plan of action on behalf of this city. It is believed that such can not be wisely done without direct establishment of general and comparable limitations. The expression of views by all the affected communities should aid in the crystallization of an equitable standard.

(During the reading of the statement the following discussion was interjected:)

Mr. NORTON. Is it expected that your report will be based on legislative action hereafter?

Mr. TAWNEY. The commission, under Article IX of the treaty, is required by the reference to report its conclusions and its recommendations, both as to the fact and extent of pollution and the remedies which the commission would recommend. That is as far as the authority of this commission goes. When that report is submitted to the two Governments, it is then up to the two Governments to adopt such plan as they may see fit for carrying out these recommendations. If they agree with the recommendations and desire to adopt them, then, of course, they will execute them. On the other hand, if the recommendations do not meet with the approval of the two Governments, possibly the report would be referred back again to the commission, with such suggestions as the two Governments might make. But it is for the two Governments, after the report has been finally made, to pass upon the recommendations and execute the recommendations, or adopt such policy as they see fit for the purpose of preventing the violation of this provision in the treaty. The commission has no final authority in the premises.

Mr. NORTON. Might it be done by Executive order, or would it require legislative action?

Mr. TAWNEY. It may be done by agreement between the two Governments or it may be done by reciprocal legislation. Whatever plan the two Governments may see fit to adopt for the carrying out of the recommendations, it is for the two Governments to say, and not for the commission.

Mr. NORTON. At our new intake last spring the intake was surrounded on two sides by ice, which was as dirty in appearance as an ordinary street. Where that dirty ice came from I do not know, but it was partly surrounding the intake at times. The sewage of something like 50,000 is going into the inner harbor because of the insufficiency of the plant, but the plans are prepared to remedy that.

Mr. TAWNEY. Under the plans prepared, this sewage in the inner harbor will be disposed of lower down?

Mr. NORTON. It will be taken into the main sewer at Ferry Street.

Mr. TAWNEY. The proposed change will not remove the pollution in the river below?

Mr. NORTON. No, sir; it would remove the interior pollution. Our lower outlet does not extend a sufficient distance into the channel; it is intended to extend that into the channel.

Mr. TAWNEY. I understand you to say that the annual cost of maintaining a sewage-treatment plant would be \$500,000?

Mr. NORTON. I said such an expense would represent so much per capita. Anything like sedimentation or chlorination would be approximately that, including capital charges.

Mr. TAWNEY. Sedimentation, chlorination, and screening?

Mr. NORTON. In a rough way I give the figures at \$1 per million gallons for chlorination and about \$3 for disinfection.

Mr. TAWNEY. What is the population of Buffalo?

Mr. NORTON. Four hundred and fifty-five thousand. In the three places below us and Niagara Falls there are something over 30,000 people.

Mr. TAWNEY. What is your present indebtedness?

Mr. NORTON. About \$31,000,000.

Mr. TAWNEY. How near the maximum are you?

Mr. NORTON. I do not know. In one case that depends upon certain bonds that have been issued with strings to them—that is, they were repayable by railroad companies—but I think we are within probably \$3,000,000 of the debt limit. There is \$1,000,000 authorized now. Our new assessed valuation will be out in the spring, and that undoubtedly will increase our bond limit anywhere from \$1,000,000 to \$5,000,000. The cities of Buffalo and Rochester are the only cities of the first or second class in the State in which the indebtedness is not exempt from that limitation. All the first and second class cities are exempt from that limitation under the constitution. If the money should come through a special amendment to our State constitution, it would take at least two years to make such an amendment. If it comes from the action of our constitutional convention, to which we elect delegates this fall, it probably will be the same length of time. It would be at least two years before we would be out from under the limitation to our included water debt, and that would be about \$9,000,000.

Mr. TAWNEY. Do you contend that because of the amount of the cost of installation and maintenance and because of the greater number of people that are involved, that your city should have the right to use the Niagara River for sewage disposal, regardless of the conditions which would injure the public health of the people below?

Mr. NORTON. No, sir.

Mr. TAWNEY. You recognize that these waters are the common property of both countries, and that the right to use them is the right of the people of both countries?

Mr. NORTON. Yes; but the latter parts of my remarks were simply suggestions along the line in which many cities have bought up the entire population on their watershed. That is sometimes a cheaper proceeding than to put in new disposal plants. It is one of the engineering alternatives which might meet the difficulty in some other way than by the entire removal or reorganization of our expensive and extensive sewerage system.

Mr. GLENN. Have you made any treatment at all of your sewage now?

Mr. NORTON. No, sir.

Mr. GLENN. You hand it raw into the river?

Mr. NORTON. Raw into the river, except with reference to the portion which enters into the inner harbor; it is as good as any septic tank there.

Mr. TAWNEY. Has your office or has the health department of the city made any effort to verify or to disprove what is contained in this progress report with respect to the pollution of the lower Niagara River, extending from shore to shore, which is an international stream?

Mr. NORTON. No, sir.

Mr. TAWNEY. Do you accept these figures?

Mr. NORTON. I have the utmost confidence in the gentleman who made that report. It seems to me, without being familiar with that kind of work, that there was a surprising amount of pollution at the lower portion of the river, increasing from Lewiston down. If

you count up the individual cross sections down the lower end of the river, they are considerably higher than at Lewiston.

Dr. McLAUGHLIN. The tests were made at different periods.

Mr. NORTON. It is out of my line to count the bugs; I do not know them when I see them, but it seems to me the report shows that.

Mr. TAWNEY. What would be the cost of installing a plant for treatment of the sewage of the city of Buffalo, so as to reduce the amount of pollution that the city is now discharging into the river?

Mr. NORTON. I have made no estimate, because we have never gone into any preparation of plans, not feeling authorized to do that until we know whether it is going to be screening and sedimentation, or screening or sedimentation, or screening, sedimentation, and sterilization.

Mr. TAWNEY. Thus far the city of Buffalo has not considered any plan looking to the treatment of sewage, for the purpose of reducing the amount of sewage discharged into the river?

Mr. NORTON. Not in the way of making any detailed plans. We have had Dr. Herring here for consultation for a day or two. We have the idea of what might or could be done. Putting the figure roughly, it would cost a dollar a million, and sterilization \$3 a million, and anything like an adequate sedimentation tank would cost us \$25,000 per million gallons. How far we would have to go in treating the first flushings might be the question to be determined. The cost of the construction of such a plant would approximate \$5,000,000.

Mr. TAWNEY. You said that the time given you was so short that the city was not able to take formal action in the matter. These reports from this commission were sent to the city on the 20th of August, about four weeks ago. Would you or your department or the health department consider the matter further and submit any more definite plan as to what the city could do and what the city ought to do in order to relieve this situation?

Mr. NORTON. That is a matter of policy which I would not want to answer, and my own best idea would be that the city would not care to submit any plan at the present time.

Mr. TAWNEY. Or make any suggestion?

Mr. NORTON. I think it would not be best for us to submit any plans now, but that is a matter of policy as to which I am not in any way authorized to speak. It would be my own impression that we should know somewhere near what would be required before we undertake to make any plans. Making plans and getting details is an expensive matter.

Mr. TAWNEY. I would not expect detailed plans and specifications, but it is the desire of the commission, as far as possible, to secure the cooperation of the cities on both sides of the line in reaching a conclusion and recommendation as to what should be done and can reasonably be expected to be done by the cities for the purpose of remedying the conditions which now exist and which the people of both countries are complaining about. That is the reason I made the suggestion. The city of Buffalo might possibly desire to make further suggestions as to remedies later on.

Mr. NORTON. It is a matter of policy which I would not wish to speak definitely about. My own opinion would be that we should have rather a more definite suggestion from your commission as to

what you would expect us to do. I realize as fully as you do your difficulties in making any definite suggestions to the different communities interested.

Mr. GLENN. Would you make a recommendation based on the fact as to what you are able and willing to do? We do not know what are your financial conditions and what are your financial abilities as well as you do.

Mr. NORTON. It seems to me that the cost of sewage treatment by the cities on the upper Niagara River would be so great that it would necessitate their study for some other solution of the problem other than that of furnishing an acceptable raw-water supply to the smaller communities on the lower Niagara.

Mr. GLENN. Don't you think your pollution affects Niagara Falls, Ontario, and Niagara Falls, N. Y.?

Mr. NORTON. I do not know, sir.

Mr. POWELL. There has been no suggestion thrown out by anyone that we should impose on Buffalo purification to the extent that the towns below, or the riparian communities below, would have a pure raw-water supply. That has not entered into anybody's mind. We are here to get information, and if we formulate a plan and ask your approval of it, we would simply be going backward and forward. We are here to-day to try and get some practical solution of the difficulty. What, in your opinion, would be the cost imposed on the city of Buffalo of having, in the first place, an independent sewerage system for its water? If you are going to work to pump all the surface water that falls in the city of Buffalo, you will have a Herculean task. What will confront us is this: Should we recommend a dual system, one to carry off the surplus water which will not be purified, and one to deal with the sewage, which is the pollution generated not by nature but by the city of Buffalo itself, and by international law and by treaty the city is bound to look after that portion of it. We do not wish to make a recommendation that will impose too great a burden on the city of Buffalo, but we want to know from you people here on the ground just how far you are prepared to go. We want to know what you think the cost of purifying your sewage would be, to the extent that there will not be thrown upon the purification plants of the lower riparian counties an unwarrantable burden. This is a practical matter, and there are certain great broad lines of solution. There is no necessity now for going into an infinity of details; there is a problem before us which every reasonable man, especially scientific men like yourselves, must have a probably approximate idea of as regards its cost. Suppose we suggest that you are to purify your sewage, and I am not speaking now of surface sewage but the sewage which is generated here in the city of Buffalo, but suppose that we declared that you are to purify that to the extent that the lower communities can then deal with their purification plants, what is going to be the cost of that to you? It is nonsense talking about hundreds of millions. We do not want to recommend the imposition on Buffalo of too great a load, but some burden has to be borne.

Mr. NORTON. If I answer that question as well as I may, it would appear to me that fine screening of our dry-weather sewage and a fair proportion of the accumulation, our present system would furnish reasonable protection to the water supplies to Niagara Falls.

That would include the dry flow and a fair proportion of the storm flow.

Mr. POWELL. The storm flow is a tremendous problem to deal with?

Mr. NORTON. Yes, sir.

Mr. POWELL. And especially here, where it would not work by gravitation?

Mr. NORTON. I think we could work that screening by gravitation.

Mr. POWELL. Could you give us an idea of the cost of your scheme?

Mr. NORTON. From such information as I have, it might amount to \$1 per million gallons, figuring on 150,000,000 at present. Add to that 50 per cent for the flushings from the sewers, and that would make something like \$200 a day, which is not an excessive amount. We have to add to that the amount for installation. The rate of \$1 a million does not make much allowance for the interest on the plant. I think that would reasonably protect the water supply between here and the Falls.

Mr. POWELL. I do not want to commit myself finally, but it would strike me as absurd to impose on the community the chlorination of all this sewage of every kind and nature, which would mean the chlorination of an immense quantity of water, when only a limited quantity will be taken by the people below.

Mr. NORTON. That is so, and, furthermore, if we arrange to chlorinate even the entire straight discharge from this city of 40 square miles, you would still have entering the Niagara River, and parallel to it within a mile or a mile and a half, the storm wash from a territory ten times as great, which would be impossible to treat.

Mr. POWELL. That would be a burden of nature imposed on the lower communities.

Mr. NORTON. I do not know whether any citizen who lives on the watershed outside the city of Buffalo has less obligation to his fellow man than the man inside the city of Buffalo.

Mr. POWELL. The city of Buffalo should look after the sewage from the water-closets and such.

Mr. NORTON. And in many cases in the country this is concentrated until the spring and it is put out on the land and it rushes off.

Mr. POWELL. But that would not be a very large factor.

Mr. CASGRAIN. Our sanitary engineers, in their opinion which was given to us in the city of New York, recommended the following:

In general, no more elaborate method of sewage treatment should be required than the removal of the suspended solids by fine screening or by sedimentation, or both, followed by chemical disinfection or sterilization of the clarified sewage. Except in the case of some of the smaller streams on the boundary, it is our judgment that such oxidizing processes as intermittent sand filtration and treatment by sprinkling filters, contact beds, and the like are unnecessary, inasmuch as ample dilution in the lakes and large streams will provide sufficient oxygen for the ultimate destruction of the organic matter.

You do not quite agree with that; all you recommend would be fine screening?

Mr. NORTON. If I understand the report, they intended to make a positive recommendation for sterilization—or was that to follow sedimentation or screening, or were these alternatives? It says: "By fine screening or by sedimentation, or both, followed by chemical disinfection or sterilization of the clarified sewage." There

seem to be two methods recommended there—fine screening or sedimentation first and chemical disinfection or sterilization second.

Mr. CASGRAIN. As I understand, what you would recommend to the city of Buffalo would be fine screening only. Do you think that would be sufficient?

Mr. NORTON. At the present time I should hope so, from my limited study of the question. I do not understand fully whether the sanitary experts intended the chlorination to follow or accompany both the fine screening and sedimentation. They are here and they can answer.

Mr. CASGRAIN. Do you agree with the sanitary experts in their recommendation contained in paragraph 6 of their report, which reads:

6. While realizing that in certain cases the discharge of crude sewage into the boundary waters may be without danger, it is our judgment that effective sanitary administration requires the adoption of the general policy that no untreated sewage from cities or towns shall be discharged into the boundary waters.

Mr. NORTON. I think that is a point on which all engineers would agree.

Mr. CASGRAIN. That is, that no untreated sewage should be put into these waters?

Mr. NORTON. We may differ as to the definition of treatment, but I agree with that.

Rev. GEORGE A. BROCK (mayor of Lockport, N. Y.). I was wondering whether the sessions of the commission are going to be so regulated that the representatives will come along in rotation. Time is valuable to all of us, and I would like to know how long you are going to sit here.

Mr. TAWNEY. We have allotted to-day and Monday next for the hearings in Buffalo. We can not determine who will be heard next until the city of Buffalo has finished its case.

Mr. BROCK. If you are only going to sit two days, I will wait my turn.

Mr. TAWNEY. If you have any particular reason, we could hear you after Buffalo.

Mr. BROCK. I only came up to-day as a scout to see what is going on, and if we are to have several days' session, I intend to bring up some gentlemen from Lockport.

Mr. TAWNEY. We contemplate that the sessions will continue to-day and on Monday.

Mr. GLENN. We might hear from Lockport and Niagara Falls before we hear from Buffalo, in order to see how much of the pollution these municipalities are receiving from Buffalo. We have had the statement from Mr. Norton, and he seems to think that Lockport and Niagara Falls are the only two places that are being injured by sewage from Buffalo. These gentlemen might be able to give us some idea of what they want Buffalo to do.

Mr. CASGRAIN. Do you not think that the investigation carried on by the sanitarians has shown us what the difficulty is?

Mr. TAWNEY. Mr. Horton, chief engineer of the State department of health, is leaving at 1 o'clock, and, if he has anything to offer on

behalf of the situation along the Niagara River, we will be glad to hear him now on the question of a remedy for the pollution that exists.

THEODORE HORTON (chief engineer of the State department of health, Albany, N. Y.). I wish, in the first place, to convey the appreciation of Commissioner Biggs, whom I represent, for the invitation to be present at this hearing. Although we are not a municipality in the restricted sense, yet we represent all the municipalities on the frontier and we appreciate being heard in this matter. Commissioner Biggs feels personally that since the chief engineer has been more in touch with the problem and has been before the commission on a previous occasion, it would be better for me to appear this morning on behalf of himself and the department. Since I have appeared here, and since at the last general hearings you had here a year ago, I expressed my own personal views in such a full and complete manner I hardly feel there is much in addition, so far as my general views on the subject are concerned, that I can offer this morning. The commissioner feels very much in cooperation with the general endeavors and aims of the commission in working out this large problem. At the same time he feels that we must look at this in a conservative light from the viewpoint that large amounts of money must be expended, and he very strongly believes that money spent on public health matters must be guided along channels that will produce the greatest good. In our experience throughout the State, in the history and the status of epidemics and out of these conditions through the State, I can find no evidence that sewage purification per se, and aside from the question of water supply, has been productive of any great lowering of the death rates. He feels there is a lot of work to be done in the municipalities throughout the State in other health work, and it is a serious question to him, and which he desires to work out, as to how best to recommend the expenditure of funds to obtain the greatest reduction in the death rate.

In regard to the question of imposing sewage purification on municipalities and water-supply purification, we feel that these primarily should be placed upon the water supply. We feel that it is productive of the greatest good to have our water supplies thoroughly protected. We feel in regard to sewage disposal that there are two or three conditions to consider, one the water supply, and another the protection of the nuisance, and perhaps, in the third place, questions with reference to bathing and general decency and matters of that kind.

Mr. POWELL. I want to get your meaning. As I understand, you say that in considering the purification of sewage there are three things to bear in mind—first, the lower riparian communities and their water supplies—

Mr. HORTON. I put that first.

Mr. POWELL. I infer from you that you must not throw upon the purification apparatus below an undue burden.

Mr. HORTON. Precisely; and of course I mean responsibility.

Mr. POWELL. And then you look upon it from the standpoint of a public nuisance more or less, and things of that kind.

Mr. HORTON. Yes; which are local.

Mr. POWELL. You do not regard that as serious as the other?

Mr. HORTON. No.

Mr. POWELL. And you do not think its effect is deleterious to a very great extent on the health of the community, although it may be objectionable?

Mr. HORTON. Yes.

Mr. POWELL. And then you take into consideration the use made of the water for bathing, and so on?

Mr. HORTON. Yes. In regard to the imposing of requirements on the various municipalities, we feel that the question of cost is so vitally involved that the most careful discrimination must be made in imposing these conditions. Take the case of the city of Buffalo. From the standpoint of a nuisance I believe that fine screening or preliminary purification of some simple kind would in all probability remove largely any question of nuisance from the river. It is my observation and the observation of those who have been analyzing in our department the conditions in the river that there is not much of this material visible, even under present conditions. We know that a very large part of our sewage consists of fairly gross suspended matter, and a large amount of it is insoluble, and if it goes into the river you can not get away from the fact that it may travel for miles and go into Lake Ontario, and perhaps across to Toronto likely, although it may not show bad bacterial results. It is this that ought to be first removed. Before we should recommend the second stage, namely, organic purification or sterilization, we should consider the requirements of municipalities below, and differentiate between sentiment and goodly return. There is a large amount of sentiment against sewage pollution, pure and simple. I think it is obvious that if the water supplies were all purified—let us assume that no water supplies were taken from Niagara River below Buffalo—it is obvious that sewage purification beyond mere screening would be unnecessary from a health standpoint. If these municipalities are forced to take their water supplies out of the river, there comes in the question as to whether they could get from certain parts of the river a supply that would fulfill the conditions laid down by the sanitary experts. I think I have shown, and I think Dr. McLaughlin has shown in his results, that there are certain threads of the stream that are largely within the limitations of the requirements of the sanitary experts.

There is a question as to whether we should require Tonawanda or Niagara Falls to carry their intakes out to that pure thread, or whether we should impose on the city of Buffalo purification to the extent of bringing the narrow cross sections within the limits set by your sanitary experts. That is a large problem, and although we can not attempt, with our limited study along that particular line, to offer a solution of it, that solution is up to your commission. We feel that a careful discrimination should be made; we believe that there should be a standard. Personally I think that the standard set by the sanitary experts is an excellent one in general. I am not a very strong believer in standards, unless there is a certain amount of elasticity to them. Rigid standards I am not in sympathy with, especially along these bacteriological lines, because, as all bacteriologists know, they are somewhat capricious when we judge them in different places and under different conditions. I do not know how far you wish me to speak in regard to this particular matter, but I

think I have expressed, in a very general way, the feeling of the commissioner of health and my own personal views. If there is anything I can supplement in any way by answering questions, I shall be very glad to do so.

Mr. TAWNEY. You are familiar with the recommendations of the engineers contained in their report?

Mr. HORTON. I have read them.

Mr. TAWNEY. I call your attention to paragraph 9:

9. In general, no more elaborate method of sewage treatment should be required than the removal of the suspended solids by fine screening or by sedimentation, or both, followed by chemical disinfection or sterilization of the clarified sewage. Except in the case of some of the smaller streams on the boundary, it is our judgment that such oxidizing processes as intermittent sand filtration and treatment by sprinkling filters, contact beds, and the like are unnecessary, inasmuch as ample dilution in the lakes and large streams will provide sufficient oxygen for the ultimate destruction of the organic matter.

Do you concur in the judgment of the sanitary engineers in respect to that?

Mr. HORTON. I do, with perhaps one additional reservation as to the nuisance locally; it is possible that that purification may not accomplish the removal of the local nuisance.

Mr. TAWNEY. There is another paragraph in this report upon which I would like to have your judgment. I refer to paragraph 6:

6. While realizing that in certain cases the discharge of crude sewage into the boundary waters may be without danger, it is our judgment that effective sanitary administration requires the adoption of the general policy that no untreated sewage from cities or towns shall be discharged into the boundary waters.

Mr. HORTON. I entirely agree with that; no untreated sewage should be discharged into any of these waters.

Mr. POWELL. What do you mean by "untreated"?

Mr. HORTON. Raw sewage.

Mr. TAWNEY. Nearly all of the sewage now discharged into the Niagara River on the Niagara frontier is raw sewage?

Mr. HORTON. Yes.

Mr. POWELL. Do you mean the mechanical treatment or the chemical treatment by chlorination?

Mr. HORTON. I would make a difference there. I mean by untreated sewage the raw sewage, and by treatment I include, first, screening; second, either chemical sterilization or organic purification, and that depends on the local conditions and the use of the stream below and the question of local nuisance. You can branch off into two different paths after you have left the road that is represented by screening.

Mr. TAWNEY. You have read the summary of the opinions of the sanitary experts, have you not?

Mr. HORTON. Yes.

Mr. TAWNEY. I refer you to paragraph 7, in which they qualify to some extent their judgment in paragraph 6:

7. The nature of the sewage treatment required should vary according to the local conditions, each community being permitted to take advantage of its situation with respect to local conditions and its remoteness from other communities, with the intent that the cost of sewage treatment may be kept reasonably low.

You agree with that qualification as to there being no untreated sewage deposited in the river?

Mr. HORTON. Oh, yes; I think that involves treatment in all cases. That is simply a reference to the choice you have. I agree with that. I think every municipality should take advantage of all resources and the adoption of any resources compatible with the requirements laid down by the sanitary experts.

Mr. TAWNEY. There is another paragraph here which is important and which I would like personally to have your opinion on:

10. Disinfection or sterilization of the sewage of a community should be required wherever there is danger of the boundary waters being so polluted that the load on any water-purification plant becomes greater than the limit above mentioned.

Mr. HORTON. I think so; in general I agree with that. I do not think there will be any exception taken to that.

Mr. GLENN. Did I understand you to say that you would suggest fine screening and leave the rest to the water plant? Did I understand you to say that you thought fine screening would be a sufficient burden to put upon the municipalities?

Mr. HORTON. I did not mean that. Screening in itself would be a fundamental requirement in all cases, but beyond that it would depend upon the local requirements. It might be a nuisance to be avoided in one case and in another case it might reduce the burden of purification down below the standard.

Mr. CASGRAIN. As I understand this summary—paragraph 9—the method which is recommended is fine screening or sedimentation, to be followed by chemical disinfection or sterilization of the clarified sewage. Take Buffalo, for instance: Would you say that fine screening or sedimentation is sufficient, or should this be followed by chemical disinfection or sterilization?

Mr. HORTON. Now, you are taking a particular case. I would agree right off that it would be necessary to have screening. When it comes to the second stage—that is, whether sedimentation beyond that or whether sterilization would be necessary—that brings in that broad question I first referred to, namely, devoting all our funds along the lines that would bring the greatest good to the greatest number. Whether it would be reasonable to impose on the city of Buffalo a very large expense of, say, \$300,000 or \$400,000, when the expenditure of 10 per cent of that would purify all the water supplies below, is a question I would not want to answer, because I would not suggest an opinion. It is a thing that has to be carefully considered.

Mr. CASGRAIN. You would have to consider very carefully what it costs before deciding?

Mr. HORTON. Yes. If the cost were along the line I have mentioned there would be possibly a saving of \$300,000 that could be devoted to other lines of health work, and Commissioner Biggs strongly believes that there is a great field for improvement along other lines of health work provided our water supplies can be kept safe—that is the chief note of our policy.

Mr. TAWNEY. What standard would you suggest as a safe loading of a water purification plant? I will read paragraph 4 in the sum-

mary of the engineers' report, and ask you what your judgment is on it:

4. While present information does not permit a definite limit of safe loading of a water-purification plant to be established, it is our judgment that this limit is exceeded if the annual average number of *B. coli* in the water delivered to the plant is higher than about 500 per 100 c. c., or if in 0.1 c. c. samples of the water *B. coli* is found 50 per cent of the time. With such a limit the number of *B. coli* would be less than the figure given during a part of the year and would be exceeded during some periods.

Mr. HORTON. Bacteriologically that represents about as close an approximation as one can reach. There are other considerations I have not seen mentioned that ought to be considered, and that is the amount of organic matter that may be present. I have in mind the Albany plant that is so loaded with organic matter at present that, aside from its bacteriological conditions, it is difficult to operate the filters satisfactorily. In other words, the organic matter is of such a nature that it clogs the filters very rapidly.

Mr. TAWNEY. Perhaps I should have read paragraph 3 of the summary report of the sanitary engineers first. It reads:

Water supplies taken from streams and lakes into which the sewage of cities and towns is directly discharged are safe for use after purification, provided that the load upon the purifying mechanism is not too great and that a sufficient factor of safety is maintained, and further provided that the plant is properly operated.

Mr. HORTON. I think that is incomplete.

Mr. TAWNEY. They are speaking in the fourth paragraph with reference to the lake waters, which are comparatively free from organic matter.

Mr. HORTON. There may be one or two or three indices. You can not keep down to the best index. The index for the *B. coli* standard for the elimination of disease germs may interfere very materially with the operation of the filters. I do not know whether that matter has been considered. Bacteriologically I agree with the statement.

Mr. POWELL. There is a vital matter that we have not touched on. Take a concrete case. Here is Buffalo, with a population of over 400,000, consuming 200,000,000 gallons of water per day. Take Tonawanda, with a population of only 25,000, and there are 20 times the people here that there are in Tonawanda. If you are going to work to chlorinate, it is for the purpose of purifying the water at the intakes of these places below. Would it not be just as well to chlorinate that water at the intake of the Tonawandas, where you would only have one-twentieth part of the burden of work that it would be to chlorinate it up here where it emerges from your screens?

Mr. HORTON. That assumes so many things that it is hard to analyze that question. It is worse than what you said, because it would take much less chlorine to chlorine water than to chlorinate sewage. As a general proposition, it would be better to do that and save that enormous amount of money—that enormous expenditure of unnecessary money at Buffalo—unless it were necessary for some other reason.

Mr. POWELL. In the nature of things, is there any reason why we can not chlorinate just as well at the intake as they can chlorinate up here, whether the water is screened or subjected to sedimentation; could you not do it just as well down there?

Mr. HORTON. I do not think I can answer that as explicitly as you asked the question. If the water was of a nature down there, without any undue burden of organic matter, it might be simple to do that, but if it was difficult on account of the sewage pollution it would make a safe chlorination, an impractical thing at the intake.

Mr. POWELL. Explain how it would be more impractical in the cast of distinctly laden material than it would be where the water was more lightly charged with material.

Mr. HORTON. That gets down into the chemistry of chlorination.

Mr. POWELL. I do not think we have our minds together. There is a certain amount of this purification to be done; leaving out the question of pollution, could it not be done just as well at the intake as here where it emerges from the sedimentation beds?

Mr. HORTON. That is, assuming that they have sedimentation tanks at Buffalo?

Mr. POWELL. Yes.

Mr. HORTON. Oh, yes; I think it would be a simple thing to do that, and it would be along the lines of conservation.

Mr. POWELL. And there is no reason why it should not be done at one place rather than at the other?

Mr. HORTON. Not the slightest.

Mr. CASGRAIN. But what kind of water would they have to drink? We heard yesterday from the people of Niagara on the Lake that they treat the water there, but the water smells bad and is bad to the taste. Would not the same thing happen in such a case as that supposed by Mr. Powell?

Mr. HORTON. Exactly. It is very difficult to answer that. If the water there is of such a nature that you can purify it by these processes, it is obvious that it is better to spend the money down there on the water supplies than to spend it up here on the sewage.

Mr. POWELL. The rendering of the water disagreeable to the taste and smell would be just as much a logical result if it were chlorinated up here as if it were chlorinated down there?

Mr. HORTON. That I am not prepared to say. That goes into the chemistry of the thing. It might and it might not. If it were applied up here, after it had been absorbed by the sewage and diluted in the water of a large cross section of the Niagara River, I think by the time it got down to the Tonawandas it might not have any odor from the chlorination. There was a suggestion about the water at Tonawanda getting an odor. That is unnecessary, according to modern practice.

Mr. POWELL. That is carelessness.

Mr. HORTON. That is carelessness; poor operation.

Mr. POWELL. Now, I have analyzed the danger we spoke of here. If that is true, independently of pollution, I suppose the effect of pollution, as would be the case of a large flow down the Niagara River, it would be still a better thing to have the chlorination at your intake below than it would be here at your sedimentation beds.

Mr. HORTON. Yes; providing no nuisance is created.

Mr. POWELL. Does it not follow with the chlorination of water here at the sedimentation beds?

Mr. HORTON. Do you mean water or sewage?

Mr. POWELL. I mean sewage. It is not as essential a feature of the problem as it would appear at first to be.

Mr. HORTON. As it would first appear to me, it would appear to be a very serious matter, and it is one about which I think there is considerable erroneous conception. As I say, it is a serious problem, but I do not consider that the waters are so seriously polluted at the present time, but that by simple purification of the sewage and proper methods of treatment of the water the public health may be very fully and amply safeguarded.

Mr. GLENN. Would not the suggestion of Mr. Powell mean that the innocent party should bear the burden instead of the offending party? If you do all the chlorination here at the intake instead of at the sewer, would not that make the innocent party bear the burden?

Mr. HORTON. You use the word "chlorination," I would rather use the word "purification."

Mr. GLENN. I am taking simply Mr. Powell's argument.

Mr. HORTON. I would consider that chlorination of the Niagara River would be necessary, under any circumstances, for the population of the watershed and irrespective of purification of sewage. There would not be any additional burden placed on the Tonawanda people for purifying the water which would have to be done anyway.

Mr. GLENN. Your argument is that if you made the sewage here as pure as possible it would still be necessary to have water purification down here?

Mr. HORTON. It certainly would, when we take into account the amount of surplus water. In regard to the question of responsibility for the cost, the municipalities below that receive sewage from above feel that they have a burden placed on them if they have to purify the water, and the people who are discharging their sewage into the waterways feel that they have a natural resource furnished by nature for that purpose and that it is an unreasonable burden for them to have to spend a great many million dollars to protect a few thousand people below. That leads me to the thought that that is a condition that may be taken care of by the commission itself. There should, perhaps, be some commission or sanitary body authorized to determine what is a reasonable and what is not a reasonable burden to be borne by the municipalities that are contiguous to the streams. We have in our own State a conservation commission that has powers in two or three different connections along that line. They determine where the burden of expense shall rest, and whether one community shall go so far toward the general desire and the other communities shall do their proportion. In that way it seems to me that if there could be worked out by joint legislation some international commission of that kind it would help to solve that difficulty.

Mr. MAGRATH. That, then, is not a function of your department?

Mr. HORTON. No; we have no authority in that, but the conservation commission has. The conservation commission is a sister commission, and it has authority over the water supply.

Mr. MAGRATH. Personally I would like you to express an opinion on this matter. Certain facts have been determined as to water conditions along the boundary line deleteriously affecting the health of your people in this State, and I would like to hear you express your views as to what should be done in order to correct the evils that have been found to exist. You say that there should be dis-

crimination, and that we should be cautious to discriminate as to the burdens which should be borne by the different communities. As you are interested in the health of the people, we would like to know what your idea would be as to the extent of that discrimination and as to how we should discriminate.

Mr. HORTON. My idea was a discrimination as to how far you are going to impose a large expenditure on the various municipalities, and do that in view of the benefits to be obtained. The expenditure of \$500,000 a year for Buffalo to purify its sewage would, in my opinion, be unwarranted, because I think that a large proportion of that money could be better spent on more efficient work in the State itself along other lines and the prevention of disease. Our commissioner feels that very strongly. Our policy from now on is to study and make more efficient the health work in the municipalities, and in that way we hope to lower the death rate perhaps more than by purification of sewage. The only harm the city of Buffalo can do through its sewage discharge, so far as I can see, is to the water supplies, and it is very fully brought out that the water supplies can be adequately protected at a very reasonable expense. Beyond the minimum requirement of screening, we ought to be cautious as to how we should impose additional burdens.

Mr. TAWNEY. You mean the water supply can be protected provided you do not impose too heavy a burden on the purification plant?

Mr. HORTON. Precisely.

Mr. TAWNEY. If this sewage is running high in B. coli it might impose such a burden on the purification plants that they can not operate.

Mr. HORTON. You can picture the condition of a municipality directly below Buffalo taking its water from the most polluted portions of the stream. They have taken it in some cases from places one hundred times more polluted than are other threads of the Niagara River. I think some jurisdiction ought to be had to require the city of Tonawanda, for example, to go farther out, where the water is purer, and therefore reduce the burden the city of Buffalo might have to carry.

Mr. POWELL. Let us get down to hardpan. What, in your opinion, would be the correct burden, in the way of purification, to impose upon the city of Buffalo with respect to purification of its waters?

Mr. HORTON. That involves such a matter of conflict that I can not go into it. If you insist on my personal views, I think it would be unreasonable to require the city of Buffalo to do anything more than remove enough solids from its sewage to preclude a nuisance below, providing Tonawanda and Lockport can obtain from any section of the river a water supply that would come within the requirements laid down by the sanitary engineers. I think on the west side of Grand Island you can get a water that is within the limits.

Dr. McLAUGHLIN. That is true.

Mr. POWELL. That might be true to-day, but would it be true in 10 years hence?

Mr. HORTON. We must impose the requirements as they are needed.

Mr. POWELL. We must look to the future to a certain extent; we must look to the population of these communities growing.

Mr. HORTON. We should add our requirements just as they become necessary in the future, keeping them down within a safe limit.

Mr. POWELL. In any consideration of conditions you would impose on the city of Buffalo screening or sedimentation to remove the solid particles?

Mr. HORTON. That is so.

Mr. CASGRAIN. Anything more than that?

Mr. HORTON. The screening is the simplest matter.

Mr. CASGRAIN. Do you say that that is all you would do at Buffalo, either screening or sedimentation, and nothing else?

Mr. HORTON. Providing we can get that jurisdiction over the water supplies at Tonawanda and these other places. I have shown that it is feasible.

Mr. POWELL. Under all circumstances you exact that?

Mr. HORTON. If you ask me whether I would impose chlorination on top of that, I would say that that is a very serious question for thought and study. I think even at best it will be quite an expensive item, and whether we should require a certain per cent of bacteriologic purification by chlorination or whether we can get along without any of it, providing the intakes are properly located, are matters for study.

Mr. BROCK. I would like to ask one question, Mr. Horton: You say that it is possible for Lockport, Tonawanda, and North Tonawanda to put intakes on the west side of Grand Island?

Mr. HORTON. I said there was a place on the west side.

Mr. BROCK. Have you any idea what it would cost those three cities to put an intake in there?

Mr. HORTON. I think it would cost considerable money.

Mr. BROCK. Would it not cost a great deal more money than for Buffalo to take care of its sewage? It has cost the city of Lockport now nearly a million dollars to get water from the river, and we have only about 18,000 people. To go away across Grand Island and put another intake on the west side of that island would financially ruin the city of Lockport. The Tonawandas are here to speak for themselves.

Mr. HORTON. In the first place, I do not know that it is necessary to go on the west side of Grand Island, and I am very sure that the bacteriological results have shown that there is on the east side of Grand Island, at a different point in the river than where the present intake is, a location that would give a quality of water, I think, within the standard or very close to it. If it is not within the standard, then that scheme is not feasible. It was in connection with the assessment of the cost that I wished to explain the position of the conservation commission for handling those questions. There should be some authority to determine what proportionate share of the expense should fall upon the respective municipalities. I do think it would be a great burden to make the city of Lockport expend per capita a very large amount for extending their intake. I do not know but what it might be very much cheaper for the city of Buffalo to pay for the entire improvement rather than provide for its own sewage.

(Thereupon, at 12.15 o'clock p. m., the commission took a recess until 2 o'clock p. m.)

AFTER RECESS.

(Pursuant to the taking of the recess, the commission reconvened at 2 o'clock p. m.)

The CHAIRMAN. Gentlemen, we expected to hear Dr. Fronczak, of the public health department of the city of Buffalo, this afternoon, but he is not present, and if the town next below here, Tonawanda or North Tonawanda, whichever one it is, is ready to proceed, we will hear the representatives of either of those towns.

STATEMENT OF MR. WILLIAM A. MOORE, OF NORTH TONAWANDA, N. Y.

Mr. MOORE. Mr. Chairman and gentlemen, what I may say is expressive, as near as I can make it, of the state of mind of the citizens of North Tonawanda. Not being fortified with expert knowledge on this subject, and not being sanitary engineers, our citizens so far have been obliged to consider the matter from the obvious things that come to our attention. For instance, at a meeting of our pure-water conference within a few months some one put a napkin over the water spigot in the restaurant where we were eating, and after 20 minutes the stench of the accumulated excreta on that napkin was so strong that you did not want it anywhere near your nose. So while we do not know how many cubic centimeters and all that sort of thing of this material there is in the Niagara River, we do know that it is not fit to be seen or used, much less drunk.

The CHAIRMAN. Do you boil your water there?

Mr. MOORE. Many people boil the water, knowing at the same time that they are drinking dead sewage instead of that perhaps full of bacteria and deleterious and health-destroying material. We watch our typhoid-fever death rate, and understand from these observances and these things that come to our knowledge that we are up against a proposition that has to be dealt with.

Mr. CASGRAIN. There is no other source of pure water, I suppose, than the river?

Mr. MOORE. No. Now, we have in this room a citizen of North Tonawanda who many years ago devised what has been known as a trunk-sewer extending from Lackawanna all the way down to Lewiston below the Falls. The idea was that into that sewer could be turned the sewage of all the cities of the frontier from Lackawanna down, and this sewage, when there is a sufficient amount of water drawn from the lake, could be delivered to a plant down there, where the sewage could be removed from the water and used for fertilizer. The water itself could be developed into an enormous water power to furnish cheap light and power for the municipalities that will have to contribute to the construction and maintenance of this sewer and the water purified and used. But that is a matter of such gigantic proportions that we know we could not assume that our financial resources as a municipality would permit us to even think of taking on our share of the financial responsibility involved therein. At the same time we realize, and it is now pretty generally understood, that the Tonawandas will be the terminal of the new barge canal, and after a long fight we have convinced the State canal

board that the Tonawanda Creek entrance is the proper entrance for that canal. We also know that the Tonawandas are to-day the initiative of more freight than any other city in New York State except New York City and Buffalo, and that with 25,000 population.

Mr. POWELL. Is it lumber chiefly?

Mr. MOORE. It may be lumber chiefly; but the concern that I am connected with in a business way moves nearly a million tons of freight itself. There are other large concerns there. Of course, the lumber, I suppose, would predominate. But it is the strategical and logical transfer point from the West to the East, and we are only looking through the gateway of our future. So it is a very serious matter to us, and we have thought a good deal about it—not from an expert slant, because we have not come to that yet. We are about to make a survey of our sewerage system, and in that is included a sewage-disposal plant. There was suggested, I think, at the last time I appeared before this conference a commercial scheme for taking care of this sewage as a by-product of a power scheme. Some of us operate a good many vessels on the Great Lakes. We know that the necessary widening and deepening of the rivers and the locks connecting the Lakes have already lowered the depth or the draft, so that to-day we can only load our big boats to 19 feet and 8 inches. When those channels and those locks were smaller and narrower and did not permit a volume of water to pass exceeding the initial springs or sources of the water we could get a greater depth of channel, but as we have widened them to the size of the modern boat the boats will carry larger cargoes than can go through these rivers or locks. Any scheme that will take an inch of water out of Lake Erie or lower the Niagara River we would oppose for reasons of navigation.

Mr. POWELL. And you are voicing the opinion of your constituency, so to speak, when you propose Mr. Bowen's scheme?

Mr. MOORE. Possibly I can not do so without letting my personal opinion come in, but I am trying to voice the state of mind of the community in which I live.

Mr. POWELL. That is the general opinion down there, is it?

Mr. MOORE. It is the general opinion down there. I understood Mr. Bowen to say that by the use of a sunken weir above the Falls we would get all the water, but being connected with interests that operate boats on the Lakes I know that the supply of water in Lake Superior will not maintain an average of 19 feet and 6 or 8 inches draft through the locks.

I have been advised recently that whereas we had thought that by the amount of water that would be thrown into a trunk sewer or an open ditch, or by whatever means the sewage was to be disposed of by a running current, a sufficient amount of water would be furnished for the amount of sewage, we are now advised by a competent sanitary engineer that the amount of water to take away the sewage under such a scheme, disconnected from any power consideration, would be comparatively small and really only what you are pumping. You know you can not pump water enough to develop any very great water power. So in Tonawanda, while we think we realize the ideal method of handling this matter, we believe that this trunk sewer is too big to consider. Then, to come down to something that seems within our resources, we perhaps have come to the reflex of it first,

and that is if the commission or the Governments should insist upon absolute nonpollution, or, in other words, if they should say that all the municipalities on these boundary waters should not pollute the waters, that is a matter so physically enormous that our municipality—and I suppose the same is true of many others—could not handle it, neither financially nor physically.

Now, it would seem to us that there are two ways or a combination of ways in which we could treat our sewage or our water supply in a manner that we might with some strain to ourselves finance a project. In other words, we are suggesting to ourselves and to you something that we could see our way clear to do. It might be burdensome, but it can be done, and I quite resent some of the statements made by Mr. Horton this morning as to the relative expense of carrying out any scheme and the proportion that Buffalo should bear and the proportion that the smaller city should bear. We recognize, of course, that Buffalo has no right to pollute the river to our disadvantage, and if we had it in our power to insist that Buffalo should not put its sewage in the river, the ones below us, or Buffalo itself, might insist that we should not put our sewage into the river, so that what was medicine for one would have to be medicine for the other. Suppose North Tonawanda could see its way clear to erect a sewage-disposal plant for \$120,000. That would mean that Buffalo could spend \$4,000,000 on one—and Buffalo is the bad boy in the situation. If Buffalo did not put any sewage in the river, there would still be plenty there; but the same conditions would not arise or the same remedies would not have to be figured out. We feel that it is within our resources to pump the polluted water into filtration beds, filter the water, and afterwards, with the use of chlorine or other means of sterilizing that water, make it fit for use; or, if the sewage is not to be put into the river by any municipality along the river or lake, then we can not turn our sewage into the river. In other words, if potable water is delivered to us we will build our sewers and turn them around into a reclamation plant and dispose of our own sewage. Of course, we could only follow what was above us in that respect. Those are two things that we feel that we may do that are within our resources. If all sewage is to be stopped from going into these waters, then we will stop our sewage from going in. If the sewage is still going to go into the rivers, we will pump out the sewage and water and filter it and afterwards chemically or electrically sterilize it and make it fit for use and turn our sewage back into the river. Now, the river looks as nice to the eye when it is full of sewage, and boats can travel up and down the channel just the same, and I would not undertake to say which is the better plan—to let the sewage still go into the stream and let each municipality purify its own water and turn its sewage back into the river, or whether it is possible to stop putting sewage into these waters, so that perhaps with the use of chlorine we could take the raw water from the stream and prepare it for family use.

The CHAIRMAN. You recognize the situation here on the Niagara frontier, I assume. The international question which confronts the commission arises from the fact that all of the cities above the Falls are contributing to the pollution of the lower Niagara, that extends from shore to shore, in violation of the provisions of this treaty. It is not so much a question, in my judgment—and I am speaking now

for myself—of stopping entirely the use of the upper Niagara for sewage-disposal purposes as it is the treatment of the sewage that is put into the river so as not to make an unreasonable burden on the purification plants of the towns or cities on the lower Niagara; so that the matter of the treatment of sewage, I assume, would be one of the serious questions that the commission would have to consider in its final report and conclusion to the Governments.

As I understand you, the city of North Tonawanda would be perfectly willing to cooperate with the commission in bringing about a solution of this matter in so far as the treatment of its sewage is concerned?

MR. MOORE. Mr. Chairman, I think you are quite right. I do not wish to exceed my prerogative in behalf of the city in which I live and am speaking for, but we do realize that the matter has to be met, and that while it is going to be a considerable strain on us, we believe that we can meet it by taking care of our own sewage. That would mean to us that cities like Buffalo are able to take care of their sewage, but the question of taking care of everybody along this waterway by sufficiently reducing the amount of sewage that went into the river, so that it would not require purification plants in treating the water and making it fit for use, is a bigger thing than I can talk about to-day.

I think I can speak for North Tonawanda and say that we can do either one of two things. We do not know, perhaps, which is better, or later on, after we have had better advice and we have perhaps had the recommendations of this commission, whether we would want to take the water as it is, filter it, and afterwards chemically or electrically sterilize and purify it, and thus make it fit for use, or whether, if the water comes to us in a fairly good state, less the major portion of the sewage, we could then use it perhaps with chlorination, or something of that sort, and then, instead of dumping our sewage into the river, dump it into a disposal plant. I believe I can say for the municipality of North Tonawanda that we will undertake to work out at least one of those two things.

MR. GLENN. Do you do anything now to purify your water before you drink it?

MR. MOORE. Those of us who can do not attempt to purify the water. We send out and buy water to drink.

MR. GLENN. But I am speaking about the city as a whole.

MR. MOORE. I can not undertake to say, but it is supposed that most people boil the water.

MR. GLENN. I mean, as a city you do not attempt to purify it?

MR. MOORE. No; we have made no attempt at all, except that I understand that our mayor, Mr. Rafter, who is here, is holding up a survey of our sewerage system; but that is being held up, as I understand it, for further information or knowledge which we might acquire through these hearings.

MR. GLENN. Have you suffered any in the way of sickness from the use of that water?

MR. MOORE. Why, good God—

MR. GLENN. You need not answer any further, sir.

MR. POWELL. Has the city ever tried for an injunction to prevent Buffalo polluting her water?

MR. MOORE. No.

Mr. POWELL. It never took any legal steps at all?

Mr. MOORE. No; they are running unexplored, so far.

Mr. POWELL. Do you plant yourselves strictly on your legal rights and say that Buffalo has no right to contaminate her water at all, or are you willing that she shall purify her water to a reasonable extent?

Mr. MOORE. I would not say offhand that we would take either ground. We recognize that the question is a very large one. We can not assume to know what is best to be done, but we do know that Buffalo and North Tonawanda are affected. Something has got to be worked out within the financial resources of those communities. I can not say what that will be. I have tried to indicate from our practical knowledge of the situation what would be within perhaps our own resources. Either one of those two things we believe that we could manage. But when the time comes that this movement of which you are now the exponents assumes the point where recommendations come to view then, perhaps, we will employ engineers to work out our detail of it.

The CHAIRMAN. What is the population of North Tonawanda?

Mr. MOORE. It is about 12,000.

The CHAIRMAN. What is the rate of taxation?

Mr. MOORE. About \$22 to \$23 a thousand and that on an increasing assessment.

Mr. GARDNER. What is your basis of valuation?

Mr. MOORE. It is about \$10,000,000 now.

The CHAIRMAN. What do you collect per capita as a revenue?

Mr. MOORE. The total revenues are about \$200,000. It costs, including our school system, nearly \$200,000 to administer the affairs of the city with a \$10,000,000 assessment and \$22 to \$23 tax rate on a thousand would explain that.

The CHAIRMAN. What is your indebtedness?

Mr. MOORE. I do not know. We have school bonds out and pavement bonds, and we always overdr̄ew our account, so that things had to be straightened up.

The CHAIRMAN. Could you furnish the commission, or have some one of your officials furnish the commission, with a complete statement of the financial condition of North Tonawanda?

Mr. MOORE. Surely. We can do that very easily, I think, before you leave Buffalo.

The CHAIRMAN. If you will do that or send the information to the commission at Washington, so that we can incorporate it into the hearings, we would appreciate it. We would like to know just what the financial condition of these municipalities is with reference to recommendations as to remedies.

Mr. MOORE. We should want you to know that in considering our detail in the matter. As I say, our sewerage system has become clogged up, and we have to spend money on that. I suppose they are going to follow with the barge canal terminus and lift bridges, and we have plenty ahead, and are even now overdrawing our account.

The CHAIRMAN. We would like to have a statement as to the population, valuation of taxable property, rate of taxation, revenues from all sources, total operating expenses, expenses for public improvements, expenses for public-service enterprises, and net indebtedness,

total funded and floating debts minus assets set apart for authorization of these debts, and the interest on city indebtedness.

Mr. MOORE. We will furnish that information to you. I want to say another word in regard to the intake of not only Lockport, but Tonawanda and North Tonawanda, in connection with a statement that Mr. Horton made this morning, and that is that those intakes were located at the precise places where the State board of health designated from their surveys. It is possible at this moment that you might find a spot for a few minutes where the water would be a little better, but the next week it would be about the same as that where the intake is located. That is almost negligible.

Mr. POWELL. What estimate is made of the cost of this long sewer?

Mr. MOORE. We have no figures on that except figures gleaned from Mr. Bowen's public statements.

Mr. POWELL. His was a big canal for power purposes.

Mr. MOORE. This would cost much more than that. An open sewer canal down through the country would be almost as bad as a river. Those aggregations keep building on the bottoms and the banks and crowd up on the banks. This trunk sewer was supposed to reach 20 feet underground by the time it reached Tonawanda. It would be built in solid rock. It would cost probably as much as a single tube in the Hudson River.

The CHAIRMAN. Does the mayor of North Tonawanda care to be heard?

Mr. JOHN A. RAFTER. No, Mr. Chairman; Mr. Moore has given our side of the case and expressed the conditions as they are. If there are any questions that the commission desires to ask in reference to our financial condition, I presume I may be able to answer them, but if you want that statement that has been asked for I will send it to you.

The CHAIRMAN. If you will have a statement prepared along the lines that have been suggested here, the commission would greatly appreciate it.

Mr. GLENN. Are your people boiling the water mostly?

Mr. RAFTER. I think not. Some of them are boiling it, but I think it is not a practice that is largely used. If there are any questions that Mr. Moore has not covered that you gentlemen desire to ask me, I shall be pleased to answer them if I can.

The CHAIRMAN. I think Mr. Moore has covered the matter from a practical common-sense standpoint. Is there anybody else from North Tonawanda who desires to be heard on this subject?

STATEMENT OF MR. W. G. PALMER, OF NORTH TONAWANDA, N. Y.

Mr. PALMER. I happen to be a member of the Board of Public Works of North Tonawanda. We have asked the aldermen for \$50,000 to provide a competent engineer to give a comprehensive survey of the town as regards a sewer and a sewage-disposal plant. It is estimated that it will cost our town \$10,000 for such a survey and plans and specifications, and after that it will be necessary for us to spend \$150,000 and maybe \$400,000—we can not tell how much—but, as Mr. Moore has said, we are looking forward to great development. Our town has expanded so that it has outgrown our sewers. If we build more we shall have to build them on the plan

of draining toward the river. We now have to have a pumping station. So that, as was intimated, the mayor is holding up that proposition temporarily to see if anything can be done so as to know whether or not we are going at the right course, and that is to build our sewerage system based upon a sewage-disposal plant, or whether we should still drain toward the river and then filter the water that we have to drink.

In regard to the typhoid, etc., that has been explained very emphatically. In a couple of words, it is something terrible. It is largely through the families of the poor. They do not even boil their water or filter it. We have a large foreign population, and they are dying as the result of drinking this water.

In my factory we have filters and we have really educated all the men working for us to the fact that they should drink filtered water. They are becoming so that they are quite afraid of the ordinary raw water. It has been hard to educate those people to the fact that they must take care of their health. The city of North Tonawanda is doing everything it possibly can, with the exception that it is furnishing raw water for the people to drink, and that must be remedied in the near future. Undoubtedly purification must be introduced in the water system. I am going to do everything possible I can to get that done. As far as either a filtration plant for the water or a sewage-disposal plant for the sewage is concerned I think we will be able to stand one of them, and if we must dispose of our sewage then we can not build a filtration plant for the water. If we must have a sewage-disposal plant we do not want to be obliged to do it until Buffalo has its plant. We can not afford both. What would be \$120,000 for us would be \$4,000,000 for Buffalo, and surely the people of Buffalo can stand \$10 a head just as well as we can stand \$4. Big figures for Buffalo are nothing as compared with small figures for us. We think Buffalo should take just as good care of the sewage as we are supposed to. We are willing to do our share.

The CHAIRMAN. If there is nobody else to be heard from North Tonawanda, we will now take up Tonawanda. As there seems to be no one present who wishes to speak on behalf of Tonawanda we will now hear Mr. Brock, from Lockport.

STATEMENT OF MR. GEORGE A. BROCK, MAYOR OF LOCKPORT, N. Y.

Mr. BROCK. Mr. Chairman, we are not troubled with the sewage so directly as the other cities on the river. Our interest in this question is getting potable water. Formerly we had our water from the Erie Canal. The pumping station is now in the city hall. The water was pumped through the mains of our city, and everybody at that time built cisterns in their homes, so that all the old houses in Lockport have drinking water in their cisterns. For instance, in my home I have been drinking cistern water for a great many years, and I am very healthy, as you can see; but lately, when New York State made over the Erie Canal into the present barge canal, they notified Lockport that it must look for a new water supply. Therefore we had to go to the river. We built a 13-mile water main from Lockport to the river. We have planted our pumping station in the city of North

Tonawanda, and our intake is out in the Niagara River, as Mr. Moore says, just exactly where the Board of Health of New York State told us to put it after making an examination of the water.

We have been pumping water now for three or four years, and possibly five years, from this source. We have been interested in the pure-water conference. The cities of North Tonawanda and Tonawanda and Lockport have formed a triple entente against the colon bacilli, and we have had numerous meetings. We have been up the river in tugboats, and we have had the experts from Albany here examining the water at various times. I wish to say that the United States Government is not altogether without fault in this matter. Rather they are somewhat to blame for the situation that exists, inasmuch as they have made a dumping ground for the rock which they have taken out of the harbor improvements in the city of Buffalo in what is known as Motor Island Channel. This Motor Island Channel was where we expected, or thought at least—we may be wrong, but we think we are not—that the best water from Niagara River came through and down on the west side of Goat or Grand Island. If you will look at the map you will see what I mean by making this statement. It was through this Motor Island Channel that we received the water that the board of health told us was fit for our municipal purposes, but the United States Government has been using this very channel for a dumping ground and has so filled it with shale rock that this better water is unable now to come through the Motor Island Channel, and all the water we get comes down through the river channel, which hugs the shores of Buffalo and the Tonawandas, and on down to Niagara Falls. In this way, even though nothing were done in any way by any municipality, the Government has very materially injured the water supply of the two Tonawandas and Lockport. It has not affected Niagara Falls, of course, because when you get farther down the waters meet again.

We are very much interested in our water supply, as I have said, and we have spent pretty nearly \$800,000. That is an awful tax on a small town of 18,000 people. It is so burdensome that it has increased our tax rate \$4 a thousand to carry that one burden of a water supply, and when we got the water in such a way that we could not use it because of the pollution in the river everybody felt as though they had bought a gold brick, and it looks as though they had. In order to correct the trouble we have put in a chlorine filtration plant at North Tonawanda. As I told you this morning, I did not expect to speak on the subject myself. I was going to ask the superintendent of waterworks and the health officer to come up possibly Monday in order to give you figures. I can say in a general way, which I think you will accept just the same as specific figures, that from the time they filled up the Motor Island Channel the colon bacilli and the excrement that came in the water was tremendously augmented. I have not the figures, but they were something terrific. Since we have put in the chlorine process the turbidity of the water has not at all been changed, but we have been able by this process to reduce the number of colon bacilli to the point where the bacteriologist at Niagara Falls who has been examining this water from week to week at our request—at \$5 an examination, too—has informed us that it is now fit for culinary purposes. I suppose he means by that for making tea and coffee and boiling cabbages and various other

things, but it is not exactly fit for drinking water as yet. We hope in time that we may get this water fit for drinking purposes so far as its sanitary condition is concerned. We never can clean it, of course, by the chlorine process.

The CHAIRMAN. What do you do with your sewage?

Mr. BROCK. I was just going to speak of that problem. Our sewage, unfortunately, empties into the Erie Canal, and we are expecting any day to get word from New York State that we have got to quit that business and proceed to attempt some scientific plan of sewage disposal.

The CHAIRMAN. How far is Lockport from the Niagara River?

Mr. BROCK. Our pipe is about 13 miles.

The CHAIRMAN. Then the sewage of Lockport is not deposited in the river at all?

Mr. BROCK. No, sir. That is why I did not speak of it. This is an international boundary question, and our sewage is a New York State question.

Now, Lockport as a community has been studying this matter for a number of years as to how to get relief, and I have presented to some of you gentlemen a pamphlet here which gives you what we consider to be the safest and cheapest and the most practical way of solving the problem, both of purifying the international water and providing the city of Lockport with a sewage-disposal system at the same time. I take it for granted that you are all familiar with this Erie & Ontario Sanitary Canal, so that I shall not enter into that question. One thing I would like to say about it is that it seems to me that it is just exactly as practical as the Chicago Sanitary Canal. If the Chicago Sanitary Canal is a good thing for the city of Chicago, I can not see why this canal would not be a good thing for the city of Buffalo and western New York. As I understand it, the people who live along the banks of the Chicago Sanitary Canal are not troubled by its odors and they are not troubled by any conditions of pollution that exist in it.

Mr. POWELL. They take an enormous quantity of water, though.

Mr. BROCK. Of course, the question here would be one of 6,000 cubic feet of water, the 4,000 which the Burton Act permits and 2,000 more. That is the thing that I imagine has prevented this thing from being considered for a long time—the 2,000 extra feet per second that they are asking for to make it a perfectly feasible power scheme.

I think that represents our interest in this matter as concisely as I can place it before you.

STATEMENT OF DR. FRANCIS E. FRONCZAK, HEALTH OFFICER OF THE CITY OF BUFFALO, N. Y.

The CHAIRMAN. Dr. Fronczak, you represent the Board of Health of the city of Buffalo, I believe. Have you any suggestions with respect to the remedies for the pollution that is shown to exist in the upper Niagara River?

Dr. FRONCZAK. I have discussed the matter at various times with Col. Ward, with Capt. Norton, and with Commissioner Lyons, and I have come to the conclusion that what we ought to do is to have fine screening to remove the major part of the solids emptied into

the river. I do not believe it is feasible at the present time to sterilize all this raw sewage or chlorinate it in any way, but simply to use fine screening, say one-quarter of an inch mesh, and by removing the greater amount of solids the total amount of pollution would be very much less. It would be cheaper for the city of Buffalo and the cities below us to chlorinate the water and sterilize it in some way. I believe the use of chlorine gas will do the work better than anything else. I base this belief on the experience we have had in Buffalo.

A month ago we began to use chlorine gas in our water and we found a decided improvement. For instance, on the 26th of last month there were 576 bacteria per cubic centimeter and previous to that time it was running 560, 625, 840, and 1,700, all in the month of August. Since the use of chlorine gas a month ago to-day it has fallen down so low that the last report—we have a report every day—shows only 12 per cubic centimeter. In other words, within five weeks the total number of bacteria has fallen from 1,700 per cubic centimeter to 12 per cubic centimeter, with no colon bacilli within the last two months. That this was not unusual was shown on September 22, when the last examination was made and we had 12; on the 21st of September, 26; on the 18th of September, 42; on the 17th of September, 38; on the 16th of September, 40; and on the 15th of September, 46. So you can see there is a general decrease, a very noticeable decrease, in the total number of bacteria per cubic centimeter. We also found that the records of the health department showed a decided decrease in the number of typhoid-fever cases. Up to September 1 we had 36 deaths from typhoid fever in 1914, while we had 38 in 1913, and 1913 was a very low year—with the exception of 1912, when we had 50 deaths in the entire year. Up to date it looks as if we shall even have lower than that. Of course, it is not all due to the use of chlorine gas, because that was only used a month, but from general sanitary conditions and the use of entire typhoid vaccination, which is being used very liberally in Buffalo—the first city in the world to provide free antityphoid vaccination. Thousands of people are now taking advantage of it, nurses, and commercial travelers, and the people who go into the country for their vacation. Most of our typhoid is due to the people who have returned from their vacation, and really got their typhoid in the country and then came to Buffalo and developed the disease, and probably died from typhoid in the city, but even that number is being reduced on account of the antityphoid vaccination. Chlorination aids it so much more.

MR. POWELL. What was the lowest number of colon bacilli previous to the use of chlorine gas?

DR. FRONCZAK. I have the record here for the months of September and August. The lowest was 92 in two months previous to the use of chlorine gas. We never got it as low as 12 until the use of chlorine gas. So far we have received between 1,500 and 1,800 complaints every day in the health department, and we have yet to hear the first complaint of taste or smell of the chlorine gas, notwithstanding the fact that we have been using it for about 30 days. We had several complaints of the use of chlorine gas from people who, before we actually used the chlorine, would telephone to us that there was taste and smell of chlorine in the water. They simply read in the papers

that we were going to use it. There was not a single complaint of the taste or smell of chlorine after it was used. In 1913 we had the highest number of bacteria per cubic centimeter in tap water—4,800—and at no time during August or September of 1913 was it below 160.

Mr. POWELL. They drank the water in that condition?

Dr. FRONCZAK. They drank the water in that condition.

Mr. GLENN. When was your heaviest death rate from typhoid fever—in what year?

Dr. FRONCZAK. The heaviest was in 1894, when 185 people died from typhoid fever in the city of Buffalo. There were 50 in 1912, 108 in 1911, 86 in 1910, and 84 the year previous. There were 90 in 1891, which was the lowest we ever had, with the exception of 1912, when we had 58. Previous to 1910 we had repeatedly a hundred and above.

Mr. GLENN. There is not much pollution above you, is there?

Dr. FRONCZAK. Except what we get from Lackawanna, Smokes Creek, etc.

Mr. BROCK. Does that mean that you had fewer cases of typhoid, or the doctors have been better able to fight it?

Dr. FRONCZAK. Fewer cases and fewer deaths.

Mr. BROCK. You think it is fewer cases, too?

Dr. FRONCZAK. Yes, sir.

Mr. POWELL. Do you think the use of that chlorine gas grants immunity or simply lessens the virulence of the type?

Dr. FRONCZAK. It probably kills all the bacteria outside of the most virulent, and their virulency is so much reduced that that probably is the cause of it.

The CHAIRMAN. Is the use of this gas general for the clarification of water?

Dr. FRONCZAK. No. I think Buffalo is the second or third city so far to use it.

Mr. NORTON. I think Philadelphia was the first large city to install it.

Dr. FRONCZAK. Hypochloride of lime is used quite commonly, but the result from chlorine gas, as we have had it during the past month, would prove to be a good investment for the city. Of course the chlorine gas does not clarify the water; it simply kills the bacteria in the water.

Mr. POWELL. How do you impregnate the water with it?

Dr. FRONCZAK. At the intake in the river there is a mixer, with a chemist and bacteriologist to regulate the mixing of chlorine gas in the water.

Mr. POWELL. How does it compare with the chloride with respect to cost?

Dr. FRONCZAK. Much less. Then the chance of giving an overdose is so much less. We repeatedly have complaints from places where they use hypochloride of lime that the smell and taste are quite strong. I believe somebody spoke of it this morning before this commission, but here in 30 days there was not a single complaint made of taste or smell of the chlorine in the water.

The CHAIRMAN. How long has Philadelphia been using this gas?

Dr. FRONCZAK. I think they have been using it for over a year.

Mr. NORTON. I do not think it is over a year. It was put in something like a year ago. I do not know the exact date.

The CHAIRMAN. Do you know what the result of the use of the gas has been there?

Mr. NORTON. Not in the way of figures. I have not received any direct report.

Dr. FRONCZAK. I believe there is a report showing quite a decrease in both the number of cases and the number of deaths from typhoid fever.

Mr. NORTON. That is used in conjunction with the filtration plant.

The CHAIRMAN. Gentlemen, have you any further questions to ask Dr. Fronczak?

Mr. DALLYN. How many parts of available chlorine are they administering?

Mr. NORTON. They are putting in normally 2 pounds to the million gallons, I believe, but, as a matter of fact, we are drawing the water from our new intake at the edge of Lake Erie to our old pumping plant and our tunnel is opened into our old intake, where the river is 3 feet lower, and there is a material flow of water out into the river. Just what that flow is I do not know. The measurements are being made now so that instead of treating 130,000,000 gallons we may have been applying it to 180,000,000 gallons.

Dr. FRONCZAK. In other words, gentlemen, we are doing what the most scientific men suggested, chlorinating the entire river—of course, we are not chlorinating the entire river, but a part of the entire river—by turning chlorine gas into it.

The CHAIRMAN. Dr. Fronczak, do you think the city of Buffalo should do anything with respect to treating its sewage?

Dr. FRONCZAK. It certainly ought to.

The CHAIRMAN. Do you think it should do anything more than fine screening?

Dr. FRONCZAK. That is all, I think, that practically should be done. Theoretically, I suppose, we ought to do more, but that would be a waste of public funds. I believe that by chlorination in the cities below and screening also in the cities below, in the Tonawandas, Lockport, etc., everybody will get good potable water at a nominal cost. If Buffalo and the cities below us would try to sterilize or chlorinate the raw sewage, I think it would be simply a waste of money, or using very expensive sedimentation beds, but fine screening, I think, will do the work and afterwards chlorinating the water which we want to drink.

The CHAIRMAN. Do you think that would end the pollution that now exists and extends from shore to shore in the lower Niagara?

Dr. FRONCZAK. I certainly believe the removal of the solids will reduce the pollution to a very great extent.

The CHAIRMAN. About what percentage?

Dr. FRONCZAK. I should believe about 66 per cent.

The CHAIRMAN. With the pollution reduced to that extent, knowing as you do the extent of the pollution in the lower Niagara, would or would not the remaining pollution be an overload for any purification plant that might be installed in the lower Niagara?

Dr. FRONCZAK. It would not be. With that reduction, certainly a responsible plant could take care of the water and render the water safe.

Mr. POWELL. That is, I suppose it might be, but with a chance to be worked not as intelligently as it should be worked, or if accidents should happen, painful results would flow. It does not give you a factor of enough safety.

Dr. FRONCZAK. I do not know exactly what you mean.

Mr. POWELL. While everything is working in good order it might work all right?

Dr. FRONCZAK. Certainly.

Mr. POWELL. But you require a considerable factor of safety.

Dr. FRONCZAK. When you remove 66 per cent of the pollution the margin of safety is so much more that even some minor mishaps will still leave that plant safe.

Mr. POWELL. The opinion of the experts in New York, Mr. Fuller and others, was that not only should it be chlorinated but there should be either sand or mechanical filters in addition.

Dr. FRONCZAK. Of course, to make a potable water perfectly safe there should be filtration and then sterilization. That is the ideal way of looking at it.

Mr. POWELL. But the general opinion seemed to be there that filtration by mechanical process or by sand beds, slow filtration, should be sufficiently perfect and thorough to make the water potable and that chlorination should simply be added as a factor of safety. That is your idea of it?

Dr. FRONCZAK. That is my idea.

Mr. POWELL. If you are throwing water largely polluted upon these lower municipalities, it would necessitate their putting in filtration beds or having mechanical filtration sufficient to purify the water, and then your argument about the cheapness of chlorination does not have the force that it otherwise would.

Dr. FRONCZAK. The position is this: By filtration and chlorination we have the ideal way of supplying potable water. With filtration you are removing all the live germs.

Mr. POWELL. Not all of them.

Dr. FRONCZAK. Well, there is a very small percentage left. With chlorination you are killing the germs. In other words, instead of drinking live germs you are drinking dead germs, which, of course, are not virulent.

Mr. POWELL. Their view is this: That the primary method of purifying the water is by filtration, either mechanical or by slow process. Then, as supplementary to that, in case of defects in the bed or in the mechanical operation of the mechanical filter, there should be chlorination.

Dr. FRONCZAK. Yes; that is the ideal way.

Mr. POWELL. They said not only is it the ideal way but it is the practical way.

Dr. FRONCZAK. That is a practical way that is provided in many cities. Hypochloride of lime or chlorine gas will not kill such a percentage of germs when the water is very roily, and when the water is filtered the use of hypochloride or chlorine gas will simply make it safer.

Mr. POWELL. My view of the theory of these gentlemen was that it was not the turbidity of the water that had to do with the deleterious feature of it at all. That result you would get by putting in another chemical, which would have the same effect as putting an egg in

coffee; it would make it settle. But outside of that they said that you should have filtration and that should be supplemented as a factor of safety by chlorination. If that be true, the more pollution that you are throwing into the water, or the more colon bacilli or other objectionable elements, such as excreta, the more thorough should be the filtration process.

Dr. FRONCZAK. But when we remove the solids it would be a mighty poor plant that would not be able to take care of one-third of the pollution.

Mr. POWELL. Mr. Fuller and others said that with a mere screening process to get anything like a pure water it might be necessary to refilter, to put it through one process of filtration and then take the effluent and subject it to another process of filtration.

Dr. FRONCZAK. Do you mean the raw sewage?

Mr. POWELL. The water to be drunk

Dr. FRONCZAK. Mr. Fuller and all of us agree that there should be filtration wherever the finances of a community will permit.

Mr. POWELL. You see the necessity for filtration is quite a factor when you are considering the superior municipality in respect to its duty to this inferior or lower municipality. That has to be taken into account.

Dr. FRONCZAK. Taking that into account, that is true, but when you remember that there are several communities with small plants supplying small communities and each one having separate filtration beds, it puts a certain expense upon them that is not practical. If all these communities will combine as they ought to, there could be a metropolitan district formed where the sewage could be taken care of by one system and the water supplied to various communities. That would be the most economical way of doing it.

Mr. POWELL. Do you not think that the real strength of what I might call your attention to is this, that it is much cheaper to purify for drinking purposes a small quantity of water than it is to purify a large quantity of sewage?

Dr. FRONCZAK. That is the idea, because in this way you are purifying the entire river. I held so in the last hearing before your honorable body, and I have not changed my mind since. There is no use of sterilizing the river when you only need a very small quantity of it for drinking purposes. There is a great amount of surface water, anyway, that is drained into the Niagara River.

Mr. GLENN. Is chlorine gas very expensive?

Dr. FRONCZAK. No. I think it will cost the city of Buffalo for the maintaining of bacteriologists and chemists and applying the gas \$25,000 or more for the care of it.

Mr. GLENN. If by using the fine screening you reduce the pollution in the river 60 per cent, then the amount of chlorine gas that these smaller towns below you would have to use would not be a very heavy burden on them, would it? •

Dr. FRONCZAK. No; it would be a very nominal cost. The most expensive thing would be the bacteriologist, who should know his business.

The CHAIRMAN. Dr. Fronczak, how does the city of Buffalo dispose of its garbage?

Dr. FRONCZAK. It burns it up mostly.

Mr. POWELL. Do you have a gehenna?

Dr. FRONCZAK. No, sir.

The CHAIRMAN. Have you a garbage-disposal plant?

Dr. FRONCZAK. We have. It is run by the city now.

Mr. NORTON. The greater bulk of our garbage is going to a fertilizing plant situated east of the city. We have a refuse plant in which we are burning our refuse, and at that plant we are burning a portion of our garbage. We have plans under way for another plant like that in which we will burn a larger portion of our garbage, and the two plants may be sufficient to incinerate all our garbage.

The CHAIRMAN. Prior to the installation of these plants what disposition was made of it?

Dr. FRONCZAK. It all goes either to the fertilizing plant where it is used for fertilizer or to the city plant where it is incinerated. It has for a great many years gone to the garbage-reduction plant or practically a fertilizer plant.

The CHAIRMAN. Have you within the last few years disposed of any of your garbage by dumping it into the river?

Mr. NORTON. No, sir; the worst we are doing is to dump the coal ashes and street sweepings along the water front in filling land which will ultimately be filled in and improved. We are now dumping street sweepings and leaves and coal ashes on that ground which adjoins the banks of the Niagara River, away inside of the channel.

The point was raised by Mr. Horton this morning as to the economic feature of life saving. I have been before the doctors here and tried to put this matter upon an entirely commercial basis, and the doctors do not agree with that cold-blooded view, namely, that to-day our highest death rate from any one disease is by far that from tuberculosis. This city has expended about \$400,000 in the erection of a proper hospital for the care of incipient tuberculosis, and it would at present appear that the city is going to save a life for the expenditure of about \$1,000. We have a death rate of something like 500 a year from tuberculosis in this city, as against 50 or 60 from typhoid. The chances of saving a good many lives by the investment of a little more money would appear to me to be better in this direction than in the prevention of typhoid. If by the expenditure of \$1,000 or \$1,500 we are able to save a life in any direction, it appears to me to be the best investment of the public funds for the benefit of the public health at present.

Mr. TAWNEY. This commission must take into consideration the international aspect of the question, because of the agreement between our Government and the British Government that these waters shall not be polluted to the injury of health or property on either side. So far as the conservation of human life is concerned within the State of New York, you are perhaps right.

Mr. NORTON. I simply throw this out as an enlargement of Mr. Horton's idea. While the city of Buffalo does not want to knock or to throw any bricks, it is perfectly plain that, so far as the city of Lockport is concerned, it is a borrower of Niagara River water, outside of its own drainage or watershed.

Mr. POWELL. You are tapping a pure watershed and the others below are tapping a water supply contaminated by Buffalo and the other communities, so the statistics of health in Buffalo would not have any bearing on this question.

Mr. NORTON. Not materially; only if they are used with the rate of the cities below us.

Mr. HOLLOWAY. I have listened to this discussion with a great deal of interest, and I came here to seek information. It strikes me that the whole problem between here and Niagara Falls is so related that it should be considered as a whole. I do not think Tonawanda or Buffalo or Niagara Falls should be called upon to work out their problem alone. It seems to me that it would be within your province to recommend a proposition that would solve the whole question.

Mr. GLENN. Having made that suggestion, have you anything practical in view?

Mr. HOLLOWAY. I have not; I am not an engineer.

Mr. TAWNEY. Is there anyone present here to represent the town of Tonawanda?

Mr. POWELL. In the printed report of the hearing held by Gen. Streeter and myself, it will be found that the town of Tonawanda was represented and went into the matter very fully.

Mr. F. S. PARKHURST, Jr. (city engineer, Niagara Falls, N. Y.). Niagara Falls, in a way, has solved its own problem. We have the highest death rate from typhoid from any city in New York, taken for several years, running as high as 1 per cent of the total population, each year having typhoid. Every family in the city was affected, more or less, and the inhabitants had to do something. Our water supply is taken from the Niagara River. We have two plants, a private company and a municipal company. When the typhoid became such a vital question in the city, the subject was very thoroughly studied and a filtration plant—a rapid sand filtration plant—was constructed. The water also received a treatment of hypochloride of lime sterilization. Our death rate is now as low as any city in New York State. There are some months when the death rate from typhoid at Niagara Falls has been lower than in any city in New York State. We laid the trouble to the doors of Buffalo, because the water was taken out of the Niagara River. The water which we get at present averages about 2,000 B. coli per cubic centimeter. That is the condition of the raw water we treat. There are places in the river where we have received counts as high as 400,000 B. coli. The water as it leaves our plant now is not absolutely sterile, but it is about 99.8 pure, almost as pure as ivory soap. As far as typhoid is concerned, we have no trouble from it in Niagara Falls, N. Y., now.

But, taking the subject in a broader manner, article IV of the treaty says that the water shall not be polluted on either side to the injury of the health or property on either side of the international boundary. To digress a little, it all comes to a definition of the word "polluted." Is it more economical to treat the water that the people are going to use immediately before they use it or to treat the waste of any community? Is the idea to have the Great Lakes in such a condition that any person at any time can go in the Great Lakes and get water which is potable? It seems to me that the attention at present is confined entirely in this discussion to the sewage from the city. Is not a great deal of the pollution of the Great Lakes due to tributary streams? As a proof that it is, there are two water courses between Tonawanda and Niagara Falls, one called the Tonawanda River and a creek which runs out at La Salle. The water which comes

out of both these streams, in the spring of the year you could fry it almost; it has a very high percentage of solid matter, and in the spring of the year, along the shore line, at our filtration plant we get very high bacterial counts. If the problem comes down to treating the sewage of the cities, it seems to me that attention should be paid to the pollution by the tributary streams, into which no direct sewage is coming. The pollution comes in indirect ways to these streams through the farm lands, by animals and other sources of contamination.

So far as the sewerage at Niagara Falls is concerned, we have spent to date \$1,400,000 for our sewers. Nature has assisted us to a certain extent. In our scheme of sewers in Niagara Falls we have brought both the sanitary and storm waters flowing in the same sewers. We have a tunnel which runs east and west and has its outlet below the lower steel-arch bridge adjacent to the power company. Into that tunnel flow our trap sewers, and into these the lateral sewers. The tunnel will average about 80 feet below the surface of the ground, right through rock, and when we get to the river bank we have a shaft which conducts it down into the river. We have seven of these tunnels, the greater part along the river bank, taking out the sewage of different sections into the river. The majority of the surface sewers in Niagara Falls are cut in solid rock. We have under contract in Niagara Falls to-day sewers being constructed which will cost about \$135,000. One of these sewers is within a very few feet of half a mile long, and is costing us \$10,000. I cite that as an example of the original cost of our sewers through the solid rock. The sewer system of Niagara Falls, costing \$1,400,000, is such that if we have to stop dumping into the Niagara River, on a conservative estimate, it would cost the city of Niagara Falls \$3,000,000. That would mean at least one-tenth of the total assessed valuation of the city.

There are a great many engineers in Niagara Falls, due to the presence in our city of power plants and chemical industries, and whenever you start talking sewage disposal to any man who is competent to discuss the subject, he will immediately hold up his hand, so far as Niagara Falls is concerned. It would be almost economically impossible to do it. It would mean that all of the sewers we have at present would have to be discarded. We have no means of putting in a filtration system, due to the tunnel arrangement. We would have to pump into the river, and there is not sufficient area at the foot of the bank, as you all know, in which we could place sedimentation basins. Niagara Falls would be simply up against it, if you ordered sewage disposal.

Mr. TAWNEY. Have you ever made an investigation to ascertain whether or not the manufacturing plants at Niagara Falls contribute to the pollution of the lower Niagara River?

Mr. PARKHURST. I think they do more good than harm, due to the fact that a large percentage of the chlorine manufactured in the United States is manufactured there. Most of the liquid chlorine used throughout the United States is made there. A large percentage of the hypochloride of lime is made in Niagara Falls, N. Y., and our sewers are consequently so full of chlorine gas that for 10 hours a day you can not get into these sewers. In some of these sewers there is an appreciable quantity of sulphuric acid

wasted into the sewers. The sulphuric acid would not have any effect upon the purification, but the chlorine will, and there is almost an artificial purification of our sewage on that account. The shafts that lead from the tunnels are 4 by 5½ feet cross section, and it would not be possible to have screens in them, because we have no means of ingress and egress between the screens.

Mr. TAWNEY. What is the cost of your purification plant?

Mr. PARKHURST. One-quarter of a million dollars.

Mr. TAWNEY. What does that include?

Mr. PARKHURST. The cost of the building and the apparatus. The cost of the chemicals is about 11 cents a million gallons. We have rapid sand filtration.

Mr. TAWNEY. What does the labor cost?

Mr. PARKHURST. I can not give you the details of that, but our total cost of pumping and chemical treatment, bacteriological examination, superintendence, etc., comes to \$5.75 a million gallons. We are pumping from 12,000,000 to 14,000,000 a day at the municipal plant. We have a very high consumption per capita of water at Niagara Falls. It is so high that the State Conservation Commission took it up with us and wanted to know why. We have a per capita consumption of 325 gallons, and the normal consumption should be 125 gallons to 150 gallons, and that is higher than the European practice.

Mr. TAWNEY. What answer did you make to the State Conservation Commission?

Mr. PARKHURST. The carbide company uses several million gallons a day and the same with the chemical factories. We had an examination made of our pipe lines to discern if there were any leaks in the system, and we found none of any moment. What leaks were found were remedied. We have a vast city on the river above the Falls, and all the sewage of Buffalo and all the sewage of Tonawanda comes right down by our gates. We take that water just as it is and treat it, and there is absolutely no menace to the health of the population.

Mr. POWELL. What depth below the surface is your sewer where it enters into the shaft?

Mr. PARKHURST. Our main trunk sewer averages 70 feet below the surface.

Mr. POWELL. What would be the cost to gather the tunnels into one and pump the sewage up for purification; it would be quite an expense, would it not?

Mr. PARKHURST. I feel like saying: "My God!" Our tunnels are distributed along two and a half miles.

(Mr. Parkhurst explained to the commissioners a map of the sewerage system of Niagara Falls, N. Y.)

Mr. PARKHURST. In order to connect all our outlets we have a length along the river bank of about 18,000 feet.

Mr. POWELL. What about pumping it?

Mr. PARKHURST. The cost of that would be enormous.

Mr. POWELL. These are facts we should have, because this matter will come up again.

Mr. PARKHURST. If you will give me an idea of what facts you want, I will get you any information that is within my power.

Mr. POWELL. What would be the cost involved in preventing the sewage from going into the Niagara River?

Mr. PARKHURST. In the neighborhood of at least \$3,000,000 to complete connecting sewers and change our system to a sewage-disposal plant, and that would be about one-tenth of the total assessment of the city. Then the annual charge would be considerable, and there would be depreciation and interest on the bond. The interest on \$3,000,000 would be \$180,000 a year, and there would be the running of the plant besides. It would undoubtedly cost the city \$10 per capita.

Mr. POWELL. What is the population?

Mr. PARKHURST. Thirty-five thousand.

Mr. POWELL. Do you say it would cost over \$300,000 a year?

Mr. PARKHURST. Yes, sir.

Mr. POWELL. Could you leave that map with us?

Mr. PARKHURST. I can not leave it, as we are using it, but I will have a copy taken and sent to you.

Mr. TAWNEY. And at the same time that you prepare a copy of that plan for the use of the commission would you send a detailed estimate of the cost of sewage disposal?

Mr. PARKHURST. Yes, sir.

Mr. TAWNEY. Have you any knowledge of the contemplated diversion of the waters of the Niagara River to a point below the Whirlpool Rapids?

Mr. PARKHURST. I have not anything specific, outside of general information. There is an idea or a scheme to take the water out of the river at La Salle, which is 4 miles up from the Falls, and to conduct it down to the tunnels below, but such a scheme would not assist Niagara Falls in disposing of its sewage in any manner.

Mr. TAWNEY. I understood the scheme was to take the water from below the Falls.

Mr. PARKHURST. There are a great many schemes.

Mr. TAWNEY. I was wondering if it would be possible, if that plan should go through, to have them connect with the sewers?

Mr. PARKHURST. It would be simply taking it from one part of the river to another; there would be nothing gained by it.

Mr. TAWNEY. Except that they could install a sewage plant down below at less expense.

Mr. PARKHURST. You could not treat the water they would take out by such a canal. There is too much water to treat. The main thing that offers itself to my mind in this is that it is a great deal cheaper to treat the water the inhabitants are going to use and immediately before they use it, instead of treating the whole volume, when other conditions are not receiving any attention.

Mr. TAWNEY. That theory might work all right if the water were wholly within the jurisdiction of the one country. We have to deal with the situation as it exists.

Mr. PARKHURST. Yes; but so far as Niagara Falls is concerned, if they have to treat their sewage and do away with the scheme existing at present, the city would be bankrupt. We have a bonded indebtedness of \$2,800,000, and we are almost up to our 10 per cent limit. We have an assessed valuation of \$36,000,000.

Mr. TAWNEY. What is your rate of taxation?

Mr. PARKHURST. 21.89.

Mr. GLENN. What do you do with your garbage?

Mr. PARKHURST. That is put into the Niagara River.

Mr. GLENN. There is a complaint about that.

Mr. PARKHURST. We do not like to put our garbage into the river, but it is simply one of the things that has to be done.

Mr. GLENN. You can stop that practice?

Mr. PARKHURST. We could, but the whole thing is to get a system which would dispose of it in an economical way. It is a question of finance. There are a great many things in Niagara Falls that we attend to a great deal better than other places do.

Mr. GLENN. Why can not you establish a fertilizer, as in other places?

Mr. PARKHURST. Buffalo is doing that, but they have a situation which we have not. The cost of shipping that over the railroads in its raw state would prohibit the idea. There are not so many cities of our size in the United States that are treating the garbage successfully. If we had a population of 150,000 we could get to the economy of the question to such an extent that it would not make so much difference. I will send you a copy of this plan. Have you any particular information along this line, concerning the sewers, which you would want? What information do you desire concerning the sewers.

Mr. TAWNEY. I was speaking now more especially of the financial position of the city.

Mr. PARKHURST. Do you want a statement of the financial condition of the city?

Mr. TAWNEY. Yes; the rate of taxation, the assessed valuation, the assessment, and the per capita rate. You might state your revenues and the expenditures you are making for public utilities. We will prepare a blank form and give it to you, so that you may fill it in. We will get from the different towns on both sides of the line a similar statement.

When we meet on Monday morning we may take some expert evidence on the statements that have been submitted to us to-day and the suggestions that have been made. If you gentlemen who represent the municipalities desire to be present when the statement of our experts is taken, I would be glad to have you here. You will be at liberty to interrogate these gentlemen if you see fit to do so.

The commission then adjourned until Monday morning, at 10 o'clock, at Buffalo.

INTERNATIONAL JOINT COMMISSION,
Buffalo, N. Y., September 28, 1914.

The commission reconvened at 10 o'clock a. m., all the members being present.

STATEMENT OF MR. RUDOLPH L. SEELBACH, OF BUFFALO, N. Y.

The CHAIRMAN. Mr. Seelbach, the commission understands that you have a sewage-disposal plan that you would like to present to it. If you have such a plan, we would be very glad to hear you. First you might state what your occupation is.

Mr. SEELBACH. My occupation at present is that of an inventor.

The CHAIRMAN. Are you an engineer?

Mr. SEELBACH. No, sir.

The CHAIRMAN. Neither a civil engineer nor a sanitary engineer?

Mr. SEELBACH. Neither.

The CHAIRMAN. Do you reside in Buffalo?

Mr. SEELBACH. Yes, sir; I do. I was born here in 1851.

The CHAIRMAN. What is the nature of your plan? First, let me ask you if you have secured the opinions of any sanitary or hydraulic engineers on the plan?

Mr. SEELBACH. No, sir; only a chemist, and my own tests.

The CHAIRMAN. You may proceed, then, Mr. Seelbach, with your statement.

Mr. SEELBACH. About 1899 or 1900 I made tests on refuse such as garbage, which has practically the same constituency as the residuum of any disposal plant. My principal tests were made with gargabe in Brooklyn and East Orange, N. J. I found that the present systems of cremating garbage were all unsatisfactory. We were then attempting to make gas out of garbage, which we succeeded in doing, but we could not find a material, neither iron, clay, nor brick, that would stand the conditions required; that is, 85 degrees of moisture against 2,000 degrees of heat. I have the evidence of Mr. E. G. Love, who is, I think, the greatest chemist we have in this country, as to our success in that direction, and also that of Mr. Isbell, of Isbell, Porter & Co., who were the oldest gas-plant builders in this country. We discovered there that in carbonizing or in creating this gas, when we put this material in the pan and put it in the retort, the carbonization would be 4 inches lying idle and no more. After that period the crust formed, which was practically a nonconductor of heat. We tried it all the way from 1 inch upward. When we got to 4 inches that was the limit; at 5 it would not cremate in the center. Two inches on each side seemed to be the limit.

Now, this cremating of residuum, such as the solids from disposal plants or of garbage, is not an engineering proposition as viewed from my standpoint and from my experience in these tests that we made. We found that any material that lies idle, unless it is stirred up or poked up, could not cremate, and I have not seen a scientific decision as to how a disposal plant with the treatment of chemicals only can eliminate the germ. Fire, of course, will do it. I have a plant here which provides a revolving process that I have tested personally, and I think it will eliminate any germ existing, whether in a disposal plant or garbage, any material of that kind. This is my claim, and that is my plan that I have submitted to the Patent Office. [Exhibiting papers.]

Mr. GLENN. Have you ever presented your plan to any cities?

Mr. SEELBACH. Yes, sir; I have.

Mr. GLENN. Have you presented it to this city?

Mr. SEELBACH. The city of Buffalo is now considering it; yes, sir. Mr. Ward has agreed to install a plant here.

The CHAIRMAN. For garbage or sewage disposal?

Mr. SEELBACH. It will handle sewage or garbage.

The CHAIRMAN. They have not agreed to install a plant for the treatment of sewage, have they?

Mr. SEELBACH. But solids of the sewage are in the same proposition. My plan here is a revolving process where the material can not lie idle. The fire goes directly on the material.

Mr. POWELL. On the inside of the cylinder?

Mr. SEELBACH. On the inside of the cylinder.

Mr. GLENN. And it burns it up?

Mr. SEELBACH. It burns it up.

Mr. POWELL. Is there some product of this operation, some gas?

Mr. SEELBACH. Certainly; there is a fertilizer product.

Mr. POWELL. Is that the only product?

Mr. SEELBACH. That is the only product.

Mr. GLENN. How much can that machine handle in a day?

Mr. SEELBACH. There can be a multiplicity of units, but this one can handle a minimum of 10 tons a day. It will handle probably 15 tons, but I claim only 10 tons.

Mr. POWELL. What would the total garbage of a city like Buffalo amount to?

Mr. SEELBACH. One-ninth of the population is the tonnage of garbage. We claim here about 50,000 tons annually, or about 150 tons per day. They burned, according to the statement made by the board of public works, about 3,100 tons this last year, and the balance was taken to the reduction works. They pay them 97 cents per ton. We claim 60 cents as the limit of fuel expense for a ton of garbage.

Mr. GLENN. Sixty cents per ton?

Mr. SEELBACH. Sixty cents per ton. They pay 97 cents now to the reduction works.

Mr. GLENN. It would take about 15 of those machines a day?

Mr. SEELBACH. About that. The labor is very small, because one man can attend to the machines; that is, one engineer to look after the machines. Then the feeding is all done automatically through chutes. There is very little labor connected with it; it is all automatic.

Mr. POWELL. The cost would be about \$90 a day?

Mr. SEELBACH. For the 15 machines.

Mr. POWELL. Does that include the interest on the capital?

Mr. SEELBACH. No; just the running expenses.

Mr. POWELL. What would the capital be per unit?

Mr. SEELBACH. The capital per single unit would be about \$10,000. For the multiplicity of units it would be a little less. We can put four units to one stack.

Mr. POWELL. What is the limit of existence of the incinerator? How long will it last?

Mr. SEELBACH. The iron will probably last indefinitely. The lining is made of brick. The Carborendum people at Niagara Falls make a brick that is acid proof, and they believe that brick would act indefinitely. It is a very expensive brick; about \$600 a thousand.

Mr. GLENN. Have you ever had one of these machines in operation?

Mr. SEELBACH. I have.

Mr. GLENN. In this city?

Mr. SEELBACH. Yes.

Mr. GLENN. Did it work all right?

Mr. SEELBACH. Yes, sir.

Mr. GLENN. You say it has been approved by this city?

Mr. SEELBACH. No; I said Mr. Ward, the commissioner, said he was going to install one.

The CHAIRMAN. You have never tested its practical value in the matter of sewage disposal, have you?

Mr. SEELBACH. The sewage disposal is the same as for garbage. I have tested the garbage.

The CHAIRMAN. The garbage is mostly dry, is it not?

Mr. SEELBACH. No; it is 85 per cent moisture, just the same as sewage. All animal and vegetable matter is the same.

Mr. CASGRAIN. How would you bring the sewage to your plant to be treated there? Would it not involve a complete change in the sewerage system of this city?

Mr. SEELBACH. No. It would not change, except they would have that system that they have in Germany of filtration from one bed to another. The sewage proposition would remain the same, and we will take care of the residuum. They now try to put the solids back into the water. They had the same trouble at Niagara Falls, where they try to put it back into the water. They dump it there on the fields. Is not that a dangerous thing to do—to take the residuum and dump it back on the fields or back into the water? It is what you want to eliminate. This plan puts the product of the earth back to the earth and eliminates all the trouble. Fire will do it, and only fire.

Mr. CASGRAIN. Have you figured out how much it would cost the city of Buffalo to use such a plan as that which you are exhibiting?

Mr. SEELBACH. I could not tell you that unless I found out, of course, how much of the solids remained, but I should not judge that that would be such an expensive operation.

The CHAIRMAN. That would amount to about 200 tons a day, I am informed.

Mr. SEELBACH. That 200 tons would require about 20 machines.

Mr. CASGRAIN. How much would it cost to operate those 20 machines?

Mr. SEELBACH. One engineer would take care of the machines. I would judge that the cost of the labor connected with that, roughly estimated, would not take over 20 men—very common men, laboring men—to operate them. I think 10 machines would do it. It is all automatic. They could put it into a cylinder on the top and run it right through into these different cylinders.

Mr. GLENN. Have you ever made a rough estimate of what the cost would be, say, in handling 200,000 tons?

Mr. SEELBACH. I should say 20 men could do it easily.

Mr. GLENN. How much all told for men, fuel, and everything else? What is the rough estimate per day?

Mr. SEELBACH. It would be 60 cents per ton, and for 200 tons it would be about \$120. The labor would average \$2 per day.

The CHAIRMAN. Not if the labor union controlled the wages.

Mr. SEELBACH. I do not know any laborer who gets more than \$2.

The CHAIRMAN. A common laborer gets \$2.50 with us.

Mr. SEELBACH. They do not here. I think \$2 would cover it. I think \$5 a day for the engineer would be a pretty fair figure.

The CHAIRMAN. This plan would have to be operated in connection with screening in the sewage-disposal plant?

Mr. SEELBACH. Yes.

The CHAIRMAN. Screening and sedimentation?

Mr. SEELBACH. Screening and sedimentation.

The CHAIRMAN. So this would be in addition to the other unit or branch of the sewage-disposal plant?

Mr. SEELBACH. Yes. We get 15 per cent of fertilizer out of that. That 15 per cent of fertilizer would more than pay the expense of running the plant. Mix that with phosphates, etc., and it would be worth from \$30 to \$50 per ton. Take the minimum of \$30 per ton, and it would far exceed the cost of the running of the plant.

Mr. GARDNER. What is the nature of the fertilizer that you produce, potash?

Mr. SEELBACH. Some potash.

Mr. GARDNER. Any phosphoric acid?

Mr. SEELBACH. A very small percentage.

Mr. GARDNER. And not much nitrogen, of course?

Mr. SEELBACH. Well, a little of that.

Mr. CASGRAIN. At first sight your idea seems to be a good one, but what I am not very clear on is, first of all, how you would work your plant in connection with the sewerage system of Buffalo, and, second, how much it would cost. I am not clear upon those two points.

Mr. SEELBACH. Mine has been a garbage proposition. I never got down to the point where I figured out the cost, except in a general way, as I would present it to you. I can say this, that the residuum will pay more than the cost of the running of the plant.

Mr. CASGRAIN. Of course, we would like to have some figures which we can judge ourselves.

Mr. SEELBACH. I will prepare them on a basis of 200 tons. So far as the plant is concerned I am not interested in that.

Mr. GLENN. How would you connect it with the sewage? I can understand how you would get the garbage.

Mr. SEELBACH. I connect it with the sedimentation plant and not with the sewerage system. I put it right next to it.

Mr. CASGRAIN. That would presuppose that the city of Buffalo would have to have a screening and sedimentation plant with which you would connect your apparatus?

Mr. SEELBACH. Do I understand that that is the sediment through the screening?

Mr. POWELL. No; it passes through a sieve.

Mr. SEELBACH. Where is the sediment?

Mr. POWELL. That is the material that escapes through the sieve, the larger solids. All the solids settle. The screening is a certain residuum that does not.

Mr. SEELBACH. I deal with the residuum problem, the sedimentation.

Mr. CASGRAIN. So far as I am concerned I would like to go beyond a theoretical proposition. I would like to bring it down to something practical. You put before us, Mr. Seelbach, a theoretical proposition, but, as far as the practical side of it is concerned I do not think you have given any arguments in favor of it. I would like you to do that.

Mr. SEELBACH. I have not taken it up with respect to what we call a sewage-disposal proposition. I claim there is no sewage sediment that can be treated chemically in any way, shape, or manner that will eliminate the germs and do what you are looking for. I will go so far as to get figures from some sewage-disposal company and present those figures to you in detail. I think that probably that would be the best way.

Mr. CASGRAIN. Yes; that information would be very welcome.

Mr. SEELBACH. As far as my operation goes I am looking forward to eliminating the troubles that the world is desirous of solving, to get rid of the germs. I do not think you are doing it by getting a sewage-disposal plant.

The CHAIRMAN. Now, gentlemen, when we adjourned here last Saturday evening it was understood that Mr. George Clinton, who represents the Erie & Ontario Sanitary Canal Co., would appear this morning in behalf of the project which this company is organized to put through for the disposal of the sewage of the city of Buffalo and other cities between here and Niagara Falls. We are now advised that Mr. Clinton, owing to illness, will not be able to appear.

It was also understood that the city of Tonawanda wanted to be heard this morning. It is now an hour after the time appointed for them to appear, and they are not present.

It was also announced to the representatives of the city of Buffalo, and the engineer representatives especially, that the commission might hear the experts who have heretofore testified before the commission on hypothetical questions for the purpose of giving the commission some information respecting the cost of water purification and sewage-disposal plants for the cities that appeared before us Saturday. The representatives of the cities are not here for the purpose of hearing what the commission's experts might have to say on the subject, and it seems to me that the hearings of our experts might, therefore, be properly postponed until such time as the commission desires to take up the whole subject.

Mr. GLENN. It seems to me they had full notice of the fact that we were going to take up the matter this morning, and they ought to have had interest enough in it to be here.

Mr. HOLLOWAY. I think Capt. Norton understood that the scheme through Lockport was to be developed this morning, and I think he intended being here a little later for that reason, because he was perfectly familiar with all the details of that. I will undertake to see that he is here, if you wish.

The CHAIRMAN. Will Mr. Norton be here by 2 o'clock?

Mr. HOLLOWAY. I will see that he is here at that time.

The CHAIRMAN. Is not the mayor of the city of Buffalo interested in this subject?

Mr. HOLLOWAY. We served notice on him. The usual procedure for the city of Buffalo is for these plans to be formulated by the department of public works. They then come before the body that I represent and afterwards go up to the mayor. By that time there has been generally sufficient discussion so that the mayor very rarely attends the actual meeting at which the matters are discussed. He gets all his data later.

The CHAIRMAN. Mr. Norton represents the board of public works?

Mr. HOLLOWAY. Yes, sir.

The CHAIRMAN. And the board of public works has full and complete jurisdiction over the subject matter of this investigation, so far as it relates to remedies for the pollution that now exists?

Mr. HOLLOWAY. All plans originate in the department of public works; yes, sir.

The CHAIRMAN. How many members are there on the board of public works?

Mr. HOLLOWAY. Col. Ward is the commissioner of public works, and he has two deputies. Capt. Norton is his deputy engineer, handling matters of this sort.

The CHAIRMAN. There is only one member of the board, then? The commissioner of public works is the only member?

Mr. HOLLOWAY. Yes, sir.

Mr. GLENN. He was examined Saturday, was he not?

Mr. HOLLOWAY. Capt. Norton was here Saturday. He is Col. Ward's assistant.

Mr. MAGRATH. Mr. Chairman, would it not be a good plan to postpone the examination of the technical men until the testimony is all in?

Mr. CASGRAIN. I think so. I for one feel that we could hear the experts with much more advantage to ourselves later on when we have considered the evidence that was given here on Saturday.

The CHAIRMAN. I think you gentlemen are right about that. You will all recall that it was the understanding on Saturday when we adjourned that after hearing the expert testimony or statements of the deputy commissioner of public works of Buffalo and the sanitary engineer of the board of health of the State of New York on the question of cost, as we did, if we took the statements of our experts in rebuttal it would be only fair to the engineer representatives of the city of Buffalo that they be present to interrogate them on the subject if they saw fit to do so. That was the reason for hearing our experts at this particular time.

Mr. GLENN. Mr. Chairman, there is no doubt about the first proposition. It has been found by all of our experts that pollution extends from shore to shore in these waters. Then we come to the second branch, and out of courtesy to all the cities along the line we notified them to be here Saturday. They were here Saturday. The article read by the engineer offered no suggestions at all. On the contrary, he said that after we had made our suggestion then he would make his. Then you said that our experts would testify and they could cross-examine them. They are not here, and I agree with Mr. Casgrain that it is not necessary for us to go any further in this matter. I do not feel that they have taken any interest in it. I feel that they have said, "You can get along the best way you can, and we will do likewise."

Mr. HOLLOWAY. I do not think that is the attitude of Capt. Norton at all.

Mr. GLENN. Well, we are here, and we notified them to be back this morning, and they are not present, and there seems to be no good reason for their absence.

Mr. HOLLOWAY. I think the reason that I suggested is a good reason so far as Capt. Norton is concerned. He though this morning would be occupied in hearing Mr. Clinton on the canal proposition.

Mr. GLENN. He did not want to hear that?

Mr. HOLLOWAY. No; he is familiar with all that matter.

Mr. GLENN. Where is the engineer who was heard the other day?

Mr. HOLLOWAY. That was Capt. Norton. He is the one I am speaking of.

The CHAIRMAN. If you will pardon the digression, I want to ask this gentleman, who represents the city council and is familiar, perhaps, with the subject, this question: Has the plan of the Erie & Ontario Sanitary Canal Co. been presented to the city of Buffalo as a means of disposing of this sewage?

Mr. HOLLOWAY. Not to my knowledge, sir. It may have been submitted to the department of public works and I not be familiar with it.

The CHAIRMAN. Do you know whether it has ever been considered by the department of public works?

Mr. HOLLOWAY. I do not.

The CHAIRMAN. The reason I ask that question is that I saw some time ago a statement to the effect that this plan had been submitted—I think it was two years ago—to the council of the city of Buffalo and rejected.

Mr. HOLLOWAY. I am quite sure that that is not the case. I have been on the board for three years.

Mr. GLENN. Did you not say that the reason that those gentlemen are not here this morning is that they are familiar with this plan?

Mr. HOLLOWAY. Yes, sir.

Mr. GLENN. They are familiar with the plan, then? They know all about it?

Mr. HOLLOWAY. Yes, sir.

Mr. GARDNER. What is the attitude of your people toward that plan, so far as you know?

Mr. HOLLOWAY. I do not know. I have not heard them express any particular attitude on the subject.

Mr. POWELL. That is the last emanation from the company, is it not [referring to the printed brief that was submitted by Mr. Bowen]?

Mr. HOLLOWAY. Yes, sir.

Mr. POWELL. I can explain that matter. Gen. Streeter and I had a committee meeting and took all the evidence that was offered as to the cost of this canal, of the gathering ground, of the watershed, and of the amount of water that would pass through and had to be disposed of. We had their engineers go into the plan most exhaustively. There also appeared before us Mr. Clinton, or some gentleman who was his solicitor, who made a very elaborate statement. We exhausted the whole business. Afterwards Mr. Bowen announced that he wished to submit a brief. This brief was submitted in pursuance of this arrangement. Mr. Bowen afterwards thought he would like to be heard still further if it were convenient to the commission, and Gen. Streeter and myself were going back to hear any further evidence he might have, but that further evidence was not Mr. Clinton's; it was some additional facts that were going to be submitted by the engineers. All the data that can possibly be gathered in this matter will appear in print as a result of the report made by Gen.

Streeter and myself, which was ordered printed by the commission. That is what that brief means. That is the brief submitted. Mr. Bowen was supposed to have notice of any further hearings so that he could present any additional evidence desired.

The CHAIRMAN. It is suggested by Commissioner Magrath that if the hearing of our experts is had later on Mr. Norton or the commissioner of public works of the city of Buffalo can be notified and can be present for the purpose of hearing what suggestions they have to make, and such cross-examination as they may wish to offer can be made at that time in the way of a rebuttal of their testimony. So the city of Buffalo would not be deprived of the opportunity of hearing what the expert sanitary engineers have to say on the subject of cost and also the matter of plans for possibly the best way of disposing of the sewage in order to prevent the pollution that now exists.

Mr. GLENN. Where will that hearing be held, Mr. Chairman?

The CHAIRMAN. Of course, we can not determine that until we get through with all the hearings.

Mr. GLENN. It will not necessarily be held here?

The CHAIRMAN. No; we may have it in Washington, and Mr. Clinton or any other representative will be notified, and they can be present to hear what the sanitary experts have to say with respect to the subject matter under consideration here at Buffalo.

Gentlemen, it is suggested that instead of adjourning now to Detroit, where we begin the hearings to-morrow morning, we take a recess until half past 2 o'clock, so that if the representatives of Tonawanda appear we can then hear them. What is the judgment of the commission?

Mr. GLENN. I do not know about that. On Saturday they were heard in the morning and they left. We asked the gentlemen from North Tonawanda to please notify them to come before us at 10 o'clock to-day, and they said they would do so. They are not here, and I do not think it is necessary for us to continue this hearing until 2 o'clock for them. If they do not take enough interest in a matter affecting them so vitally to come here, it is not our lookout.

Mr. CASGRAIN. On second thought, that is true. It is now nearly half past 11, and they have not sent us any word that they are coming or that they are on the way and will be here later.

Mr. GLENN. I believe in giving everybody an opportunity to be heard, but a little courtesy is due us as a commission, and we have not had it.

The CHAIRMAN. If it is the pleasure of the commission, then we shall stand adjourned until to-morrow morning at 10 o'clock.

(The commission thereupon, at 11.15 o'clock a. m., adjourned to meet in the city of Detroit, Mich., at 10 o'clock Sept. 29, 1914.)

INTERNATIONAL JOINT COMMISSION,
Detroit, Mich., Tuesday, September 29, 1914.

The International Joint Commission met at Detroit, Mich., on Tuesday, the 29th day of September, 1914, in pursuance of the consideration of the reference in relation to the pollution of boundary waters.

Present: Canada—T. Chase Casgrain, K. C. (chairman); Henry A. Powell, K. C., Charles A. Magrath, Lawrence J. Burpee (secretary). United States—James A. Tawney (chairman), Obadiah Gardner, R. B. Glenn, Whitehead Kluttz (secretary).

APPEARANCES.

Dominion Government: Dr. Montizambert, C. M. G., superintendent general of public health.

United States Government: Dr. Allan J. McLaughlin, of United States Public Health Service, and Prof. Earle B. Phelps.

Province of Ontario: Mr. F. A. Dallyn, representing provincial board of health, and Dr. John Amyot.

Municipalities represented: City of Detroit—Oscar B. Marx, mayor of Detroit; Richard I. Lawson, corporation counsel, city of Detroit; Dr. W. H. Price, health officer of the city of Detroit; George H. Fenkell, commissioner of public works and city engineer; Theodore A. Leisen, city engineer for the water board of the city of Detroit; James Vernor, alderman of the city of Detroit; Dr. Charles H. Oakman, president of the board of health, city of Detroit; John F. McKinlay, secretary of the board of health, city of Detroit; John L. Burkhardt, secretary and executive officer, city board of health. State of Michigan—Edward D. Rich, State sanitary engineer; Dr. Victor C. Vaughan, president of the State board of health.

Mr. TAWNEY (chairman of the American section of the commission). The purpose of this meeting of the International Joint Commission in Detroit is generally understood, although it may not be out of place for me to read the notice of the meeting which was sent by the secretaries of the commission to the municipalities on both sides of the line. The following is the notification:

SEPTEMBER 3, 1914.

DEAR SIR: I am directed by the International Joint Commission to notify you officially as mayor of Detroit that under the treaty between the United States and Great Britain, signed at Washington, January 11, 1909, it is provided by Article IV as follows:

"It is further agreed that the waters herein defined as boundary waters and waters flowing across the boundary shall not be polluted on either side to the injury of health or property of the other."

On the complaint of the people of both Canada and the United States, that this provision of the treaty was being violated, the Governments of the United States and Canada, on August 1, 1912, under Article IX of the treaty, referred to the International Joint Commission for investigation and report, with its conclusions and recommendations, the following questions:

1. To what extent, and by what causes, and in what localities have the boundary waters between the United States and Canada been polluted so as to be injurious to the public health and unfit for domestic or other uses?

2. In what way or manner, whether by the construction and operation of suitable drainage canals or plants at convenient points or otherwise, is it possible and advisable to remedy or prevent the pollution of these waters, and by what means or arrangement can the proper construction or operation of remedial or preventive works, or a system or method of rendering these waters sanitary and suitable for domestic and other uses, be best secured and maintained in order to insure the adequate protection and development of all interests involved on both sides of the boundary, and to fulfill the obligation undertaken in Article IV of the waterways treaty of January 11, 1909?

In order to answer the questions set forth in the first branch of the above reference, an extensive field investigation to determine the origin, degree, and extent of the pollution of these boundary waters was carried out by the com-

mission in 1913. The facts of pollution having been ascertained, as shown by the accompanying progress report, there remains for the commission in answering the second branch of the reference, to investigate and determine what remedies should be recommended to the two Governments for the pollution found to exist and the means of applying and maintaining such remedies.

Under the plan adopted by the commission for the conduct of the investigation of the second branch of the foregoing reference, the following steps are necessary:

1. Securing opinions from leading sanitary engineers upon questions relating to general policy and consultations with the sanitary engineers and sanitarians to be employed by the commission.
2. Hearings to enable all interested parties to present their views and facts as to what remedies they would advise and are capable of installing and maintaining, hearings to include any expert testimony submitted.
3. The collection of all available knowledge and data bearing upon the most approved methods of water purification and sewage treatment.
4. Formulation of advisable requirements for each locality according to local conditions and necessities as shown to exist as the result of the investigation by the commission, and the report of the sanitary experts on the pollution of the boundary waters between Canada and the United States.

Accordingly, the commission has obtained the opinions of six eminent sanitary engineers, Messrs. George W. Fuller, Earle D. Phelps, and George C. Whipple, for the United States; and Messrs. F. A. Dallyn, W. S. Lea, and Theo. J. Lafreniere, for the Dominion of Canada. The testimony of these experts established the broad fundamental principles upon which any remedial action must be based and indicated clearly the procedure which should be followed by the commission.

The commission has now reached the very important step in the plan of procedure providing for hearings to enable municipalities and all interested parties to present their views and facts, including such expert testimony as they may desire to present, as to what remedies they would advise, and are capable of installing and maintaining, that will prevent or remedy the pollution which now exists in contravention of the provisions of the treaty above referred to.

For the purpose of affording your municipality and its representatives an opportunity to be fully heard in respect to the prevention or remedies for the pollution of the waters of the Niagara River by the discharge of sewage of your municipality in said river, the International Joint Commission will meet in the city of Niagara Falls, beginning at 9.30 a. m. on Friday, September 25.

For the convenience of the commission, it was suggested that in the meantime you select such representatives of your municipality as you may deem advisable to prepare and present such plans for sewage disposal or treatment as in their judgment would adequately meet the requirements of the foregoing treaty in respect to the pollution of said river.

For your convenience and use in preparing for this hearing, I am sending you under separate cover:

1. Copy of the treaty and rules of procedure.
2. Copy of the progress report on Pollution of Boundary Waters, including the report of the sanitary experts.
3. Copy of the Résumé of Testimony of Consulting Sanitary Engineers.

Yours, truly,

SECRETARY.

The purpose of the commission meeting in Detroit is to hear what the people of Detroit, those in charge of and responsible for the administration of your public affairs, have to offer in the way of suggestions to the commission. I may say, also, that at this same meeting there were other towns and cities on this side of the line that were notified to be present, namely, Ecorse, Wyandotte, Trenton, Gibraltar.

I may say, further, that the action of the commission under Article IX of the treaty is not final. The jurisdiction of this commission is twofold. It has final jurisdiction under all of the provisions of the treaty where it has any jurisdiction, except under Article IX, and under Article IX its jurisdiction is investigative. The two Governments referred to the commission, under Article IX,

questions for investigation and a report of its conclusions and its recommendations. That is the function of the commission in this investigation. It has to report to the two Governments our conclusions with respect to the facts, also our conclusions with respect to what remedies are necessary to prevent further violation of the treaty between Great Britain and the United States, wherein they have solemnly agreed that neither will permit the pollution of the waters marking the boundaries between the two countries, to the injury of health or property of the other. I presume that the city of Detroit has taken this matter up with a view of presenting what it desires to present in the way of remedies for the pollution which is shown, by the report of our expert sanitary engineers, to exist in the Detroit River as the result of the use of that river as a sewer. The waters of this river also furnish the supply of water for domestic uses to all the cities on the other side of the line, and on this side below the city of Detroit.

Mr. RICHARD I. LAWSON (corporation counsel of the city of Detroit). I think, may it please your honors, that it will be stated on the part of the city of Detroit that to some extent the waters of the Detroit River are being polluted by the sewage of the city. I think it will also be conceded that the water supply of the city, which is taken from the river, is exceptionally free from contamination, as compared with the water supply of other cities similarly situated. I do not think it will be conceded that the sewage of the city of Detroit pollutes the water on the other side of the river any more than that the sewage on the other side of the river pollutes the water on this side. I think both parties are guilty of the same offense, but to what degree I am not able to state.

The city will cooperate with this commission to remedy, so far as lies within its power, the pollution of the waters by our sewage, but the city desires suggestions from the commission. This commission, I understand, have made a very extensive investigation of the boundary waterways, and from their investigation they are perhaps better able to suggest remedies than the city is to offer suggestions for remedies. Our neighbors below on this side of the river complain sometimes of our dumping our sewage into the river, but I do not think their complaint in many respects is well founded. I do not think that their health is in any more danger from the disposal of our sewage than the health of our own inhabitants. Our health officer and our health board will be able to demonstrate that, I think, to the satisfaction of this commission.

The commission may rest assured, as I said before, that the city of Detroit will cooperate with this commission in any reasonable way to reduce the pollution as far as possible.

Mr. TAWNEY. I may say for the commission that we are very glad to hear you make that statement. That is all we expect, the cooperation of the principal cities in endeavoring to find some practical and efficient remedy for the evil that is shown to exist as the result of the investigation which this commission has already made. You say the city of Detroit is willing to cooperate as far as it is able to. Let me ask you to what extent, or whether your officials at the heads of the different departments in the city have considered the extent, to which the city of Detroit is able and willing to cooperate in the matter of discovering and putting in practice remedies

for that evil. We all recognize that there will have to be necessarily more or less expense, and we simply desire to inquire for the purpose of bringing out the practical side of the thing as soon as possible.

Mr. LAWSON. The city will, if given time, meet the expense of any practical system that may be installed. We will have to have time, reasonable time, but it seems to me that the matter we should determine first is the plan.

Mr. TAWNEY. That is unquestionably true. Have you seen the testimony of the sanitary engineers and the résumé of their testimony which the commission took in the city of New York last June?

Mr. LAWSON. I read it hastily.

Mr. TAWNEY. You are not an expert in that matter, and therefore I will not ask you your opinion as to the correctness of their conclusions.

Mr. LAWSON. That is all a matter of health and engineering rather than law, and I am only the legal adviser of the city, and I will give way now to the health officer.

Mr. GLENN. Are you treating your sewage now or is it raw?

Mr. LAWSON. Raw; we are dumping it into the river raw.

Mr. TAWNEY. Who would be best qualified to give the commission the statistics as to the financial condition of the city of Detroit, your rate of taxation and valuation, and so on?

Mr. LAWSON. I think the controller would. I can give you the assessed valuation and the rate of taxation.

Mr. TAWNEY. What is the population?

Mr. LAWSON. The population, we claim, is about 700,000. The last census shows 560,000, and that was in 1910.

Mr. TAWNEY. What is the assessed value?

Mr. LAWSON. About \$600,000,000.

Mr. TAWNEY. What is your rate of taxation?

Mr. LAWSON. About \$20 per thousand; our debt is about \$10,000,000 or \$12,000,000. Of course, we have the school debt to be added to that, which brings it up to about \$14,000,000. The controller is here and he can give you the exact figures. He tells me the debt is about \$17,000,000,000.

Mr. TAWNEY. You have a limitation beyond which you can not go in the matter of contracting debt?

Mr. LAWSON. We have a general State law which permits us to increase our power of borrowing money from time to time. For many years, and perhaps for 50 years, the debt limit was 2 per cent. That was increased recently to 4 per cent, and it may be under the State law increased to 8 per cent, beyond which it can not go without legislative action.

Mr. GARDNER. What is the basis of your valuation?

Mr. LAWSON. Full value, cash value. That is not always observed, but it is probably observed here as nearly as it is in any other community in the country.

Mr. GARDNER. I do not know whether it is observed on the other side of the line or not?

Mr. LAWSON. They seem to have money there, and I suppose they must get it from taxation.

Mr. TAWNEY. I know it is not observed in Minnesota.

GEORGE H. FENKELL (commissioner of public works). The city engineer is not present just now, but I expect he will be in before long.

MR. TAWNEY. You are familiar with the plan of your city for the disposal of the sewage, as it now exists?

MR. FENKELL. I am reasonably so.

MR. TAWNEY. And also with respect to the plant that you have installed and in operation for the purification of your domestic water?

MR. FENKELL. I am.

MR. TAWNEY. Will you describe the plant which you have now in operation for the disposal of your sewage.

MR. FENKELL. The city of Detroit covers about 42 square miles. The ground slopes quite gradually from the river and gradually acquires an inclination of about 60 feet. Leading to the river, in as direct courses as could well be built at the time, the various sewers we built are a considerable number of sewers which empty into the river. Above Woodward Avenue, which avenue divides the city into about equal parts, there are 23 outlets, and below Woodward Avenue there are 27, a total of 50. There are in addition some private sewers, how many I am not able to state, but their number and location, I think, can easily be determined.

MR. TAWNEY. Are these sewers from large manufacturing plants?

MR. FENKELL. Those that I have knowledge of are. These sewers have been built at various times.

MR. TAWNEY. What is the estimated amount of sewage that these sewers accomodate?

MR. FENKELL. As far as I have information, no precise determination has been made, at least recently.

MR. TAWNEY. Can you approximate it in gallons?

MR. FENKELL. The city engineer yesterday estimated the dry-weather flow to be 163 cubic feet per second. He was unable to estimate the storm flow, but he estimated the capacity of all the sewers for storm-water flow as 7,882 cubic feet per second. These sewers are generally built of brick and the outlet is partly under water and partly exposed to the air during normal stages of water. There are times, I believe, when most of the sewer outlets are entirely exposed to the air. At other times they are submerged to some extent.

MR. TAWNEY. Your present system is so planned as to take care of the flood waters as well as the sewage in dry weather?

MR. FENKELL. It is. It is a combined system. I may add that some of these sewers are quite old. Detroit was the pioneer in some ways in the direction of public works. It is so situated that it is unable to secure water from wells. Even from the earliest day all water supplied to the people living in this community has been obtained from the river. Sewers were built here many years ago and I think there is a considerable number of sewers now in service that were built previous to 1850.

MR. TAWNEY. All the sewage that is deposited in the river is raw sewage?

MR. FENKELL. As far as I know, yes.

MR. TAWNEY. You do not treat the sewage at all?

Mr. FENKELL. We do not.

Mr. GLENN. What do you do with your garbage?

Mr. FENKELL. The garbage is collected by the city and the equipment for doing the collecting work is owned by the city. All garbage is taken to one station, loaded on cars, and turned over to a private company. This company takes the garbage into the country, about 25 miles out, and reduces it.

Mr. GLENN. It is not emptied into the river at all?

Mr. FENKELL. There is no garbage emptied into the river, as far as I have any knowledge. I have no knowledge of any refuse of any kind being emptied into the river. Occasionally barrels may be observed floating in the river, and these may have dropped off tugs or boats, but I have no knowledge of any dumping of refuse or garbage of any kind into the river.

Mr. GLENN. Do you purify your water in any way at the intake?

Mr. FENKELL. Mr. Leisen, the engineer for the water board, is here and will give you more details about that than I can. It is treated, I know, with hypochlorite of lime. That treatment was begun regularly somewhat over a year ago. Some two or three years ago a temporary plant was put in, because it was thought that it might be necessary to open the old intake in case of anchor ice, and this plant was built so that in case it was necessary to do that it should be used. That plant was not put into regular operation until a year ago last spring, when the typhoid fever death rate of Detroit increased somewhat, and it was thought advisable by the board of health to put this in. The treatment was begun then at the rate of 3 or 4 pounds per million gallons and was gradually increased until it was being treated at the rate of about 7 or 8 pounds per million gallons.

Mr. GLENN. What is the condition of the water at your intake?

Mr. FENKELL. The intake is about 2 miles below the outlet of Lake St. Clair, and before the present intake was located I made a survey of the upper part of the Detroit River to determine, if possible, the best location for that intake. At that time I was employed by the water board of the city. Many floats were run, many current meter measurements taken, and temperature readings were taken for some time. As far as was determined at that time, and as far as I know has been determined since, there is no shore pollution which reaches the intake. The river flows with a velocity of from perhaps half a mile to 3 miles an hour, depending upon the stage of water in the Lakes, and the outlet from the water which reaches the intake enters the river some little distance out from shore in the lake. Usually the water is quite clear. Storms, however, rile the water out in Lake St. Clair because of its shallowness, and we may have water with some turbidity under some conditions, provided we have a storm which stirs up the lake. The most serious period of turbidity occurred a year ago last spring. I think all the cities along the Great Lakes, especially Toronto, had very serious conditions at that time because of the various great storms which prevailed.

Mr. POWELL. You do not filter the water?

Mr. FENKELL. No. I may say I was connected with the work of the board of water commissioners until a year ago last July. Since that time Mr. Leison, who is present now, has had charge of that

department and can furnish the information concerning the water supply.

Mr. POWELL. Is the water at the intake subjected to any systematic bacteriological examination?

Mr. FENKELL. I am not able to state what is done at the water works. Dr. Price, the health officer, has had investigations of that kind carried on for some years, and I think they are still carried on.

Mr. TAWNEY. Would any change that would have to be made in your present sewerage system, for the purpose of remedying existing pollution, come under your jurisdiction as commissioner of public works?

Mr. FENKELL. So far as I know, it would.

Mr. TAWNEY. This matter of the pollution of the waters of the Detroit River by the disposal of Detroit sewerage into the river has been under consideration and under public discussion in the city for several years, more or less, has it not?

Mr. FENKELL. It has been discussed some, but not to any very great extent.

Mr. TAWNEY. The fact that this question has been referred to the international joint commission for investigation, and that the investigation, in the first branch of the reference, namely the question of pollution, has been known to the city of Detroit and its officials, has it not?

Mr. FENKELL. I think it has been known, though not very generally.

Mr. TAWNEY. It has been known to your health department?

Mr. FENKELL. I may say that about a year ago now I spent one or two days in Buffalo and talked to some of the officials at Buffalo concerning other things that had to do with their city, and they told me about the investigation that was being made by your commission. That was the first I knew about it, and since that time I have heard that investigation was going on in Buffalo, but I knew little of the work of the commission.

Mr. TAWNEY. Has your department so far given any consideration to any change in your present system that would result in or have the effect of either purifying the sewerage or reducing the amount of pollution, or of preventing pollution?

Mr. FENKELL. We have given it consideration. I think all of the city officials have considered it to some extent, but no specifications have been asked for or made, to go ahead with this work, because we did not understand what was wanted or expected.

Mr. TAWNEY. What plant did you contemplate installing, or what plan did you contemplate putting into operation? Have you any estimate of what the cost would be?

Mr. FENKELL. I have not. I think before a plan could be decided upon it would first be necessary to determine somewhat the result that would be obtained, and then I think it would be necessary to conduct an investigation to determine what would be the best thing to do. Detroit has its peculiar problems like all cities, and even the construction of an intercepting sewer is not as simple as it might appear to be, for the outlets of all these 50 sewers are somewhat below the level of the water in the river. These sewers are quite flat, or the slope is quite slight, and an intercepting sewer along the river front would drain the river, unless precautions were

taken to keep the river out. What to do with storm water has never been determined, nor did we ever have any idea as to what would be the wishes of the commission as regards storm water. If it is necessary to build a separate system of sewers, some time would be required, and a considerable preparation would be necessary to carry that object through. The sewers in Detroit have cost about \$15 per capita.

Mr. GLENN. You mean the existing sewers?

Mr. FENKELL. The existing sewers.

Mr. GLENN. Have you ever discussed the question as to whether your sewage could be treated by fine screening, and as to what would be the effect on the pollution of the water?

Mr. FENKELL. That matter has been discussed to some extent, and we have thought about it considerably. There are, of course, matters which have to be considered in connection with it, such as the location of the screening plants. The present sewers empty into the river at the lower end of the streets, usually, but in many cases the streets are closed and the sewers pass through private property in order to reach the river. It would be impossible for me or for, I think, any one connected with the city to determine upon any plan without a very careful investigation. I believe it is of the very greatest importance to all concerned that whatever is done shall be done to the best of our ability and knowledge. I am not familiar with the screening; we have made no experiments in screening.

Mr. POWELL. Nor with sedimentation?

Mr. FENKELL. Nor with sedimentation either, nor with septic tanks nor filters.

Mr. POWELL. You have had no experience with the disposal of sewage in any shape?

Mr. FENKELL. No; we know something about what our neighboring cities are doing, but Detroit has carried on no investigation.

Mr. CASGRAIN. Have there been any complaints from the municipalities on the other side of the river below Detroit, in relation to the dumping of the sewage of Detroit into the river?

Mr. FENKELL. I have seen newspaper articles concerning Amherstburg, but I have heard but little from the other cities below here. I have been told that the typhoid death rate was higher below here than it is in Detroit.

Mr. GLENN. What is your typhoid death rate here?

Mr. FENKELL. I am unable to state; Dr. Price will tell you better than I can.

Mr. TAWNEY. The progress report of our sanitary engineers shows that.

Mr. POWELL. What is the total of water in the city per capita?

Mr. FENKELL. I think it is slightly over 100,000,000 gallons per day. Mr. Leison, of the water board, will give you the exact figures. It is near 180 or 190 gallons per capita. I may say that in computing per capita consumption or the death rate per 100,000, there have been statistics published which were rather misleading. In some cases the population is computed by what is sometimes called the straight-line method, and I believe in some of the government departments they continue that method. That may be very satisfactory for some cities, but the population of Detroit, since an early date has increased in a different ratio from that. The population

for a few years previous to 1910 was computed by that method to be much less than the city actually had, as was determined by the Government census of 1910.

I mention this because various statistics have been published based on the estimated population determined in that way, which I think are acknowledged at present to have been misleading. The population of Detroit is determined with very great precision by the water board, for the reason that nearly all families in the city use the city water. There are no wells here, or very few. This country is made of clay, and if one endeavored to dig a well he would find there was very little, if any, seepage into it. It would remain dry. The water board is able, therefore, to give the number of families in the city with great precision, and they can figure from one Government census to another very closely.

Mr. TAWNEY. Do not a great many families buy water?

Mr. FENKELL. I think but few. The water rate is very low here. I think there are very few families who get their water supply from some other houses—or did you refer to the purchase of distilled water? I can only speak from my personal knowledge. I have no statistics. I think the use of various kinds of purified water is very limited.

Mr. POWELL. Are there not complaints in your city as to the effect of chlorination, as being disagreeable to taste or smell?

Mr. FENKELL. I can only speak of that previous to a year ago last July. There were very few complaints received by the water board up to that time. The amount of lime used was not great enough to make serious trouble. Many have told me they could detect it, but since that time I do not know what complaints have been made.

Mr. POWELL. What is your own experience?

Mr. FENKELL. I have not been able to detect it for some months. At one time I thought that I could, and my family claimed that when the hot water was drawn into the bathtub they could detect the chlorine. Complaints were received previous to that time, because of the effect it had on fish; some of the fish hatcheries or aquariums were affected by the use of the lime. But to what extent it hurt the fish I am not able to state.

Mr. TAWNEY. As I understand you, your city recognizes the fact that this is an international problem?

Mr. FENKELL. Yes, sir.

Mr. TAWNEY. And in so far as the city of Detroit can reasonably cooperate with the commission in finding a remedy, and with the Governments of both countries in executing any recommendation the commission may make, your city stands ready and willing to do whatever may be reasonably required?

Mr. FENKELL. Most decidedly.

Mr. TAWNEY. I desire to say that the commission has not any arbitrary conception as to any remedy. What recommendation it may make to the two Governments in the matter, that has not even been considered as yet. We are trying to get such information as we can from the different cities as to their attitude toward the settlement of this investigation, and also of their willingness and desire to cooperate with us.

Mr. ENGEL (city controller). When you get all through, is it the intention of this commission to recommend plans for each community?

Mr. TAWNEY. I can not say what the commission may recommend.

Mr. ENGEL. But you do intend to recommend something?

Mr. TAWNEY. There will be recommendations made to the two Governments. It is our duty to do that with respect to the remedies for the evil that now exists from the pollution of these waters in violation of this treaty.

Mr. ENGEL. That remedy would not be the same in each community?

Mr. TAWNEY. I anticipate not, because the conditions, as you will see from the letter which has been sent, vary at different cities.

Mr. ENGEL. A recommendation will be made to the city of Detroit as to what the commission would like this community to do.

Mr. TAWNEY. That will be the case.

Mr. GLENN. Personally, I would like to get from you, and from these other gentlemen, your suggestions from your standpoint. If we can put all our heads together we may come to some conclusion that will be best suited from the interests of all. If you have any ideas on that, we will be glad to know them.

Mr. ENGEL. I think I am perfectly safe in stating on behalf of the city that this is practically new business to us. There has been no meeting of the heads of the various departments to take this matter up on any large scale at all. We have simply talked over it from time to time, but we have never done anything. We have always been under the impression that our water was in pretty fair condition. I would like to hear from Dr. Price, our health officer, along that line, because I understand he makes daily tests.

Mr. CASGRAIN. That is not the question put to us; whether your water is good or not is not the question we have to determine.

Mr. ENGEL. We have been thinking of ourselves; perhaps.

Mr. CASGRAIN. The question is whether you pollute the water to the detriment of the cities on the other side lower down.

Mr. ENGEL. I have no relations of mine living down there, and I do not know what they are doing.

(Dr. Price, medical health officer of the city of Detroit, was then called.)

Mr. TAWNEY. I want to make this suggestion for the information of the experts who are here. The commission has a sanitary engineer from each country and also sanitary experts who may be called at the close of this hearing. If they have any suggestions to make, and if we do call them, I would like that any engineer or expert from the city of Detroit should have an opportunity of interrogating them. If we present any expert testimony as to the local situation here, you will be given an opportunity of interrogating the experts.

Mayor MARX. I would like your experts and engineers to avail of an opportunity of going around the city and seeing our sewers and water supplies. Our engineer will take them around.

Mr. POWELL. You might extend that invitation to the whole of us.

Mayor MARX. We will be quite glad if you come. We will furnish the conveyance to take the commission and their experts around.

Mr. TAWNEY. I think it is desirable that we should have that opportunity before we leave the city.

STATEMENT OF DR. WILLIAM H. PRICE, HEALTH OFFICER OF THE CITY OF DETROIT.

The CHAIRMAN. Dr. Price, we would be very glad to hear from you in connection with the situation that exists in the city of Detroit with regard to the pollution of the Detroit River.

Dr. PRICE. I do not know that I can add anything to what has already been said with respect to the situation. There can be no question in the mind of anybody who has analyzed the situation that as it prevails here the water supply below the city of Detroit must be polluted. If any evidence were needed to prove that, that evidence is available to anybody who wants to undertake the getting of it together, and this commission has certainly got it together in a very compact form and in very lucid shape. I suppose it could have been expected that at some time something would have to be done to bring about a correction of such a state of affairs as that. I can not conceive of anyone arguing against such a correction being brought about in the most reasonable way for everyone concerned to make it effective. I understand that that is the particular point that the commission is interested in, and we have a sanitary engineer and a chemist on the board of health. It so happens that both of them are rather recent appointees. They have been in office since the first of the year. We have discussed this matter, although not in an official way at all, and have realized that it is an important problem and at the same time a very large problem, and it is very necessary that the matter be started in a proper way. I do not know that I have anything further to offer.

The CHAIRMAN. Dr. Price, have you seen the summary of the testimony of the sanitary engineers taken by the commission in New York City?

Dr. PRICE. Yes; I have.

The CHAIRMAN. Do you agree with their conclusions stated in the sixth paragraph of that summary, which is as follows:

While realizing that in certain cases the discharge of crude sewage into the boundary waters may be without danger, it is our judgment that effective sanitary administration requires the adoption of the general policy that no untreated sewage from cities or towns shall be discharged into the boundary waters.

Dr. PRICE. My understanding of that résumé in the whole was that no such contamination should be permitted to exist that would impose a greater burden upon the purification plants below than could be handed perfectly.

The CHAIRMAN. But in the sixth paragraph it is their judgment that effective sanitary administration requires that no untreated sewage in cities or towns should be discharged in these boundary waters.

Mr. POWELL. That means the raw sewage.

The CHAIRMAN. Yes; the raw sewage. They consider that it is not good sanitary administration to permit raw sewage to be discharged into these boundary waters. That is the sum and substance of it and I simply ask what your judgment is as to whether that was correct or not?

Dr. PRICE. Judging from the other parts of the report relative to the pollution which exists in Detroit, and accepting the report of the engineers of the commission, I would say that so far as Detroit is concerned it is a necessary condition.

The CHAIRMAN. You say, as I understand you, that it is your judgment that so far as it relates to the Detroit River here that no untreated sewage ought to be deposited into the river.

Dr. PRICE. That is my understanding.

The CHAIRMAN. Now, paragraph 9 of the summary of the sanitary engineers reads as follows:

In general, no more elaborate method of sewage treatment should be required than the removal of the suspended solids by fine screening or by sedimentation, or both, followed by chemical disinfection or sterilization of the clarified sewage. Except in the case of some of the smaller streams on the boundary, it is our judgment that such oxidizing processes, as intermittent sand filtration, and treatment by sprinkling filters, contact beds, and the like, are unnecessary, inasmuch as ample dilution in the Lakes and large streams will provide sufficient oxygen for the ultimate destruction of the organic matter.

As a health officer, do you concur in the judgment of the engineers as to that?

Dr. PRICE. Yes, sir; I think so.

Mr. GLENN. Have you given any thought to the question of what would be best for Detroit with respect to treating the sewage before emptying it into the river?

Dr. PRICE. As far as coming to any conclusion is concerned, we have not. We have talked it over.

Mr. GLENN. Have you discussed the question of fine screening or sedimentation or any of those other remedies?

Dr. PRICE. The sanitary engineer and I have discussed them, but as far as coming to any conclusion is concerned, we have not.

The CHAIRMAN. It is the general consensus of opinion, however, that something must be done, as I understand it.

Dr. PRICE. When the typhoid rates that exists are taken into consideration, it is plain to anyone that something wrong is happening, and, naturally, the conclusion would be that something must naturally be done, the sooner the better.

Mr. POWELL. Dr. Price, let us suppose for a moment that the cities were nonexistent and you had simply an agricultural district of small communities. The water of the Detroit River would receive a certain degree of pollution, would it not, from uplands?

Dr. PRICE. Yes, sir.

Mr. POWELL. So it would be unnecessary to have the outflow of the sewerage system purer than the water would be as a result of the drainage from the surrounding country?

Dr. PRICE. Yes, sir.

Mr. POWELL. Then, your position would be this: It is not necessary to impose upon any of these cities the making of the water absolutely pure, so to speak, and the question is then the amount of purification the commission should recommend; that is what we should have Buffalo do and what we should impose upon the riparian communities lower downstream.

Dr. PRICE. I should think that would be the idea exactly.

Mr. POWELL. Now, as I understand your answer to the chairman's question, you think Detroit would do its full share if it subjected its sewage to screening or sedimentation and a certain amount of chlorination, or would you go as far as requiring chlorination?

Dr. PRICE. As I say, we have not definitely come to an exact conclusion, and it would be impossible for me to attempt to outline a specific plan, because, as Commissioner Fenkell has said, it is a very big proposition. Assume that pollution does exist and everyone should participate in accomplishing correction for the benefit of public health and safety. I could not speak more definitely than that.

Mr. POWELL. Do you know anything about the degree of the pollution here at the water intake?

Dr. PRICE. There is an evidence of some pollution at the Detroit intake.

Mr. POWELL. Do you take bacteriological records?

Dr. PRICE. Yes, sir; we do.

Mr. POWELL. Are those tabulated and preserved?

Dr. PRICE. Yes, sir. They have been kept since the 1st of January. There is evidence of some slight pollution there. We believe that whoever located the intake at its present location used a very great deal of judgment in placing it there—that it must have involved a great deal of experiment and work to have located in that particular place, for, as far as we have been able to tell, that one particular spot is the safest in that part of the river or anywhere near that part of the river, and the pollution at the intake is very small as compared with any of the surrounding points. There is some slight pollution there.

Mr. POWELL. To what do you attribute that? Do you attribute it to vessels passing up and down?

Dr. PRICE. There seems to be some pollution from the vessels, but, at the same time, the country above the city of Detroit is being very rapidly built up.

The CHAIRMAN. Are there summer resorts in that vicinity?

Dr. PRICE. Yes; and all-the-year residents. People live out there all the year round. Just what percentage each one would be causing that pollution I am not able to say.

The CHAIRMAN. Are there any organized towns or villages?

Dr. PRICE. Yes, sir.

The CHAIRMAN. With sewerage systems of their own?

Dr. PRICE. Yes, sir.

The CHAIRMAN. That dump into the river above your intake?

Dr. PRICE. Into the lake above.

The CHAIRMAN. Into Lake St. Clair?

Dr. PRICE. Yes, sir. After the water is treated and comes into the basin there is evidence of a marked improvement, and that improvement continues through the taps, so that only once or twice so far this calendar year has there been any evidence of any pollution whatever, so far as *B. coli* are concerned, in the water that comes through the taps.

Mr. POWELL. That is, after it has passed through the chlorination process?

Dr. PRICE. Yes, sir.

Mr. POWELL. You have never given consideration, I suppose, to the consideration of the pollution of the water by the large marine population on the river?

Dr. PRICE. Not beyond the general knowledge that it must exist. There must be a factor there, but we have not gone any further than that. The matter did come up last spring between the Lake Carriers' Association and the water board, and I talked to one of the employees of the water board about it. We discussed the question as to how far boats might reasonably expect to retain sewage in order to reduce the pollution that might arise at the Detroit intake from that source.

Mr. POWELL. You are of the opinion, then, that the sewage, so to speak, from the vessels should be purified before allowed to pass into the stream?

Dr. PRICE. I do believe that; yes.

Mr. POWELL. You are dosing your water supply pretty heavily with this chlorine?

Dr. PRICE. I think six and a half pounds to the million gallons.

Mr. POWELL. Can you tell us what number of colon bacilli you found to a cubic centimeter of water, as a general thing?

Dr. PRICE. Of the raw water?

Mr. POWELL. Yes.

Dr. PRICE. At the intake?

Mr. POWELL. Yes.

Dr. PRICE. I have those figures tabulated, but I have not them with me and could not state them definitely.

The CHAIRMAN. Just at the intake it is 2.5 and above the intake it is 25.5.

Dr. PRICE. That particular point is the best that could possibly be chosen to locate an intake.

The CHAIRMAN. That would appear to be true from our bacteriologic examination. Below the intake it is 18 and above the intake it is 25.5, while at the intake it is 2.5.

Dr. PRICE. At the same time that would not be taken to mean that that was absolutely satisfactory.

Mr. POWELL. At times it might be greatly increased?

Dr. PRICE. It might, and that condition might change. I can conceive of how changes could come about whereby that condition, as far as it prevails at the present time, would be obliterated.

Mr. POWELL. Then, to sum up what you say, there is a remarkable unanimity, so to speak, between the statistical returns of our commission and your own statistical returns.

Dr. PRICE. Yes, sir; there is.

Mr. GLENN. As an expert, Doctor, what percentage of pollution would be taken out of the raw sewage by fine screening?

Dr. PRICE. I am not an engineer, Mr. Commissioner, and I could not attempt to answer that question.

Mr. GLENN. I thought you were an engineer.

Dr. PRICE. I am a physician; I am not an engineer.

The CHAIRMAN. If the engineer representing the water board is present we would be glad to hear from him now.

STATEMENT OF MR. THEODORE A. LEISEN, GENERAL SUPERINTENDENT OF THE WATERWORKS OF THE CITY OF DETROIT.

The CHAIRMAN. Mr. Leisen, you have heard the testimony of the commissioner of public works on the sewerage system and also Dr. Price's statement. You are in charge of the water board, are you not? You are the engineer of the water board?

Mr. LEISEN. Engineer and general superintendent.

The CHAIRMAN. What is the daily consumption of water?

Mr. LEISEN. For the year ending July 30 last it will average about 110,000,000 or 111,000,000 gallons daily.

The CHAIRMAN. What would that be per capita?

Mr. LEISEN. Of course, that question of pollution is an indeterminate one. Approximately it would be about 160 to 175 gallons per capita.

The CHAIRMAN. Has the subject of sewage disposal been under consideration in your department in connection with other departments of the city government?

Mr. LEISEN. No; our department would not be brought into any discussion of that matter under ordinary conditions, unless it were in a special advisory capacity. Our intake being above the city, we would not naturally be directly interested in the matter.

The CHAIRMAN. Your department has no jurisdiction whatever over the sewage-disposal plant?

Mr. LEISEN. None whatever; no, sir.

Mr. POWELL. Give us in gallons the average daily flowage of sewage.

Mr. LEISEN. I should say it would approximate the pumping of water, about 110,000,000 gallons. I think you will find, as a general proposition, that the so-called dry weather or sanitary sewage approximates very closely the pumping.

Mr. POWELL. But with the storm flow.

Mr. LEISEN. With the storm flow I have not an idea what it is.

Mr. GLENN. Your department has nothing to do with that, you say?

Mr. LEISEN. Nothing whatever.

Mr. GLENN. What department has that work?

Mr. LEISEN. The department of public works.

The CHAIRMAN. I understand the sewers drain the entire area of the city, about 40 square miles. With the storm flow the whole area of the city would be drained through your existing sewer pipes?

Mr. LEISEN. Our sewers also drain a certain quantity of Highland Park.

Mr. ENGEL. They have an 18-inch opening in the Woodward Avenue sewer. I will further state at this time that there is a movement now on to permit them to connect with another large sewer that we know of as the Morell Street sewer, so that shortly the sewage of Highland Park may be passing through our Detroit sewers.

Mr. LEISEN. With reference to article 6 that you read a while ago, Mr. Chairman, is that to be understood as meaning absolutely all sewage?

The CHAIRMAN. I understand it as meaning untreated sewage. I understand it is the consensus of opinion among sanitary engineers and sanitary experts or bacteriologists who have investigated the

matter that no raw sewage ought to be permitted to flow into these boundary waters.

Mr. LEISEN. Assuming that a partially separate system were in operation during times of excessive storms, the flow would have to go out into the river, in which event it would be likely to carry with it a certain limited proportion of highly diluted raw sewage, and in the conditions existing here it would seem to be impossible to avoid that. Of course, it is absolutely impossible to consider treating the storm-water flow. I do not assume that your commission would for one moment consider that as a reasonable possibility. Unless you have an absolutely separate system, unless your sanitary sewers are distinct in every part of the city from your storm-water sewers, there would always be a liability to a certain amount of sewage going out into the streams during the storms, and so that to use the word "all" does not in my opinion convey a correct impression. I would differ from that conclusion. It is a good deal like absolute purity; you do not get it. If the other system were adopted, exception might be taken to it under those considerations.

Mr. POWELL. That would not be impregnated with larger matter than the ordinary country sewers, would it?

Mr. LEISEN. I do not think it would. It would probably be about the same as surface water. If there were no sewage, it would go out into the rivers and could not be prevented.

Mr. POWELL. I did not just exactly catch your idea. Is it this: If you allow the storm waters to go through the same ordinary sewers of the city that the purification of such a mass would be impracticable?

Mr. LEISEN. Yes; absolutely so.

Mr. POWELL. Your view is then that the two kinds of sewage should be kept distinct?

Mr. LEISEN. To a certain extent by utilizing the storm water in some instances by sanitary sewers and by the means of interceptors, diverting the sanitary sewage in dry weather, but in cases of heavy storms it is bound to be carried out with whatever storm waters come down at that time, so that then you are knowingly emptying a certain amount of raw sewage into the river, and while that may be the spirit of that recommendation it is not the letter.

Mr. POWELL. I think probably the recommendation applied somewhat to sewage as we understand it and not surface sewage.

The CHAIRMAN. The language here bears out Mr. Powell's construction of that. The sixth paragraph of the summary states:

It is our judgment that effective sanitary administration requires the adoption of a general policy that no untreated sewage from cities or towns shall be discharged into the boundary waters.

They are referring to the general conditions and not to the exceptional conditions that arise in the event of storms.

Mr. LEISEN. And not to the sewage which might be included in the storm water.

The CHAIRMAN. And that was what all the sanitary engineers and bacteriologists understood. When they incorporated in the résumé the judgment of the engineers with respect to no untreated sewage they meant a sewage that was generally carried through the sewerage systems of the different cities and not the storm sewage.

Mr. LEISEN. Regarding the water supply, we make daily analyses of the water at the intake in conjunction with the health department, and we have those records more or less complete for some time. We have them absolutely complete for the period since the 1st of January to date. If they are of any interest to the commission, I would be very glad to furnish them.

The CHAIRMAN. Can you furnish them conveniently?

Mr. LEISEN. Yes; for the last three or four months.

The CHAIRMAN. You may furnish them, then, before we adjourn the hearings.

Mr. LEISEN. We can furnish such records from now on, if they are desired.

Mr. POWELL. Mr. Leisen, I would like your opinion as an expert, first from the economical standpoint and second from the standpoint of efficiency, as to whether or not you would recommend two independent systems or a combined system?

Mr. LEISEN. From the standpoint of economy—I am not speaking of any local conditions here, because I am not familiar with them—I would recommend what we call a partially combined system. In other words, certain sewers that might be purely for the purpose of sanitary sewage, and others which for a certain length would combine both storm water and sanitary sewage, the sanitary sewage to be diverted by means of an interceptor at some point during dry weather, and then during storms this interceptor would be passed by jumping over a weir and the water carried out into the river, carrying with it whatever sewage, untreated sewage, might be in the sewer during that time.

Mr. POWELL. With respect to efficiency and with a view to obtaining this standard which these experts have set, which is a partial purification of the water such as would be obtained by the result of fine screening and sedimentation, which system would you recommend? Would you recommend two independent systems of sewerage?

Mr. LEISEN. Well, I think that would be a problem which would have to be determined in each particular case. The local conditions would govern that. As to the final cost of treatment, of course, a totally separate system would be the more economical, because you are bound to have a slightly less quantity to treat. On the other hand, in order to keep your entirely separate system clean you have got to divert a certain amount of rain water from the roof to keep it flowing out, so that the difference would not be so great as might be at first considered, and I think in both instances the combination of the two systems would work out most economically.

Mr. POWELL. Preferable both from the standpoint of efficiency and economy?

Mr. LEISEN. Equal in efficiency, preferable from the economic standpoint.

Mr. GLENN. Have you ever been to any other cities where sewage was treated or examined?

Mr. LEISEN. Yes.

Mr. GLENN. Have you ever made an investigation to see what system was the best, the screen or the sedimentation or the chlorination?

Mr. LEISEN. I question whether there has been any system devised that has been absolutely satisfactory. Possibly the most complete plant built in recent years was the plant at Columbus, Ohio, with which one of your advisory engineers, Mr. Fuller, was thoroughly familiar. That plant uses sedimentation and sprinkling both. There the results at first were not entirely satisfactory, but I have understood—I have not been there for a few years now—that they have since proved very satisfactory.

That plant, however, has one drawback which would not be satisfactory here. The sewage there is first drawn into certain sedimentation basins or tanks and the residue or sludge which collects is washed out into the river during periods of storm. That applies all right to the river there possibly because during storms it may be utilized to advantage, but here with the problem that is confronting you, you could not afford to use that system. Some other means would have to be provided for removing the final deposit or the sludge. In Worcester, Mass., which is one of the best examples of the earlier disposal plants, the sludge was pressed into bales, and I think originally an attempt was made, without success, to use it for fertilizer. The effluent from the sewage at Worcester, when the plant there was first built, was very high in its standard of purity. Now, I am not able to give you figures on these things. I have not looked the matter up, and I have not made any special preparation to answer questions of that kind, but I simply cite those two cases as ones with which I am reasonably familiar. The conditions at Baltimore, Md., should furnish the best guide, both as to the experimental work and their completed plant, when it is finished.

Mr. GLENN. What do they use?

Mr. LEISEN. Sedimentation and the sprinkling methods both, and I think, also disinfection. The disinfection is one of the latest adjuncts and one of the best.

The CHAIRMAN. Mr. Fuller was one of the engineers employed at Baltimore, was he not?

Mr. LEISEN. I think he was.

Mr. GLENN. Have you seen any plant where fine screening is used, so that you can state what effect it has?

Mr. LEISEN. No; I have not. I should not be inclined to place much stress upon the advantages to be derived from it, except as it might apply to a bathing beach. It might keep the visible matter away. I doubt as to its purifying.

Mr. GLENN. My question was prompted by a statement of a gentleman in Buffalo that fine screening would take away 60 per cent of the pollution and leave only 40 per cent for the cities below to treat, which amount could easily be treated by chlorine gas.

Mr. LEISEN. I could not controvert that idea, but it does not appeal to me. In my judgment it is not correct.

Mr. GLENN. It was controverted by some of our experts.

Mr. POWELL. Mr. Leisen, you would like to investigate the matter further, would you?

Mr. LEISEN. Before I would guarantee 60 per cent removal through screening I would.

Mr. POWELL. You are familiar with the problem here, are you?

Mr. LEISEN. I have only been in Detroit four months, so my familiarity with the conditions here is limited.

Mr. POWELL. But you know the "lay of the land"?

Mr. LEISEN. Yes, sir.

Mr. POWELL. Is there in your judgment any peculiar feature in the problem of sewage disposal here in the city of Detroit that results from local conditions?

Mr. LEISEN. No; unless it might be the lack of heavy grades. In other words, the river, practically speaking, is level for the full distance of the city frontage, and that would necessitate, if an intercepting sewer were constructed along the full frontage of the city, a considerably larger sewer on account of the low flow than if a higher gradient could be obtained.

Mr. POWELL. Would it be necessary to introduce a pumping system?

Mr. LEISEN. Yes.

The CHAIRMAN. You have no pumping system now, have you?

Mr. LEISEN. There is one pumping station up the river.

Mr. POWELL. Which would you recommend, independent pumping systems or the gathering of the sewage at each one of these output exits, or intercepting sewers, and the taking of it all to one place where it could be dealt with?

Mr. LEISEN. I think that is purely a question of economy.

Mr. POWELL. You have not looked into it sufficiently to give an opinion?

Mr. LEISEN. No; I have not. I have not looked into the sewerage question here at Detroit at all. I can only say that I have always been a strong advocate of purification of sewage by cities on any stream or lake whose waters are required for drinking purposes, and my only regret is that your commission has not the power to go down the Ohio and the Mississippi and several of our other rivers and enforce regulations there in the same way that you hope to bring them about here on the boundary waters. In every community in the country where the streams or lakes required for drinking purposes extend into more than one State trouble exists in this particular line, and it results in a good deal of sickness and disease, and, of course, the compulsory use of filtration in a great many sections of the whole country.

The CHAIRMAN. Gentlemen, it is now 12 o'clock. As it has been planned that the commission and its experts, as well as the experts of the city, will visit the waterworks plant and the sewerage plants of the city this afternoon, the commission will stand adjourned until to-morrow morning at 10 o'clock.

(The commission thereupon, at 12 o'clock noon, adjourned until 10 o'clock a. m., Wednesday, September 30, 1914.)

INTERNATIONAL JOINT COMMISSION,
Detroit, Mich., Wednesday, September 30, 1914.

The International Joint Commission resumed its inquiry here this morning on the reference with regard to the pollution of boundary waters.

Present: Canada—T. Chase Casgrain, K. C. (chairman), Henry A. Powell, K. C., Charles A. Magrath, Lawrence J. Burpee (sec-

Dr. PRICE. Judging from the other parts of the report relative to the pollution which exists in Detroit, and accepting the report of the engineers of the commission, I would say that so far as Detroit is concerned it is a necessary condition.

The CHAIRMAN. You say, as I understand you, that it is your judgment that so far as it relates to the Detroit River here that no untreated sewage ought to be deposited into the river.

Dr. PRICE. That is my understanding.

The CHAIRMAN. Now, paragraph 9 of the summary of the sanitary engineers reads as follows:

In general, no more elaborate method of sewage treatment should be required than the removal of the suspended solids by fine screening or by sedimentation, or both, followed by chemical disinfection or sterilization of the clarified sewage. Except in the case of some of the smaller streams on the boundary, it is our judgment that such oxidizing processes, as intermittent sand filtration, and treatment by sprinkling filters, contact beds, and the like, are unnecessary, inasmuch as ample dilution in the Lakes and large streams will provide sufficient oxygen for the ultimate destruction of the organic matter.

As a health officer, do you concur in the judgment of the engineers as to that?

Dr. PRICE. Yes, sir; I think so.

Mr. GLENN. Have you given any thought to the question of what would be best for Detroit with respect to treating the sewage before emptying it into the river?

Dr. PRICE. As far as coming to any conclusion is concerned, we have not. We have talked it over.

Mr. GLENN. Have you discussed the question of fine screening or sedimentation or any of those other remedies?

Dr. PRICE. The sanitary engineer and I have discussed them, but as far as coming to any conclusion is concerned, we have not.

The CHAIRMAN. It is the general consensus of opinion, however, that something must be done, as I understand it.

Dr. PRICE. When the typhoid rates that exists are taken into consideration, it is plain to anyone that something wrong is happening, and, naturally, the conclusion would be that something must naturally be done, the sooner the better.

Mr. POWELL. Dr. Price, let us suppose for a moment that the cities were nonexistent and you had simply an agricultural district of small communities. The water of the Detroit River would receive a certain degree of pollution, would it not, from uplands?

Dr. PRICE. Yes, sir.

Mr. POWELL. So it would be unnecessary to have the outflow of the sewerage system purer than the water would be as a result of the drainage from the surrounding country?

Dr. PRICE. Yes, sir.

Mr. POWELL. Then, your position would be this: It is not necessary to impose upon any of these cities the making of the water absolutely pure, so to speak, and the question is then the amount of purification the commission should recommend; that is what we should have Buffalo do and what we should impose upon the riparian communities lower downstream.

Dr. PRICE. I should think that would be the idea exactly.

stances the intake was changed. Of course we do determine and we do dictate as to how they shall dispose of their sewage in these cities, but we have endeavored to bring about the remedies that we have prescribed with as little friction as possible and without resorting to the courts, which we have the power to do. We have warned, and we do warn the people and warn the municipalities, and we are now outlining a general plan which will afford guidance to the different municipalities in the State as to how sewage shall be treated.

Mr. TAWNEY. If, in the judgment of the State board of health, the disposal of the sewage along the shores of the lake or into the Detroit River results injuriously to the health of the people, has your board the power to require the installation of sewage-treatment plants by these municipalities?

Dr. BURKHART. Yes, we have; we can control it, and they must do whatever the board determines.

Mr. MAGRATH. Before a sewerage system can be installed, I understand each municipality must have its plans adopted by your board.

Dr. BURKHART. Yes, sir; all sewerage plans and waterworks plans are submitted to the board. I have the law here. The State law of Michigan is published by the board of health, and it provides for that.

Mr. POWELL. Will you send a copy of that to the secretary?

Dr. BURKHART. I shall be pleased to do so. That book gives every law pertaining to public health in the State of Michigan, compiled in 1914. I may say, however, that until the past year and a half we had not instituted an exact supervision of the water supply and the disposal of sewage, because it is only within a year and a half that we have been empowered to employ a sanitary engineer who is thoroughly competent to do the work.

Mr. CASGRAIN. Do I understand you to say that there was under consideration a general plan for the disposal of sewage?

Dr. BURKHART. Yes, sir.

Mr. CASGRAIN. Would it affect the city of Detroit?

Dr. BURKHART. It would affect every town, village, and corporation in the State of Michigan, private corporations and public corporations.

Mr. POWELL. What remedial measures are in contemplation?

Dr. BURKHART. I would prefer to let Mr. Rich tell you that when he comes to the stand, because he has been dealing with the plans. I know what they are, of course, but we depend entirely on the sanitary engineer for the plans, and then they are submitted to the board.

Mr. CASGRAIN. Within what time approximately would this system come into operation?

Dr. BURKHART. The general plan now that we adopt or have adopted, or have advised the municipalities to adopt, is to treat the water with hypochloride. That is the general plan. There must, of course, be some basis to work from, and that will have to be developed by the sanitary engineer's plans. What that will be I am not prepared to say.

Mr. POWELL. That is only one end of the problem; what about the sewage?

Dr. BURKHART. The sewage will have to be dealt with, too. Of course, each city will have to be taken up individually, but there must be some basis for all.

Mr. CASGRAIN. Let me read to you the ninth paragraph of the summary of the opinions given by the sanitary-engineers of the hearing in New York in June last:

9. In general, no more elaborate method of sewage treatment should be required than the removal of the suspended solids by fine screening or sedimentation, or both, followed by chemical disinfection or sterilization of the clarified sewage. Except in the case of some of the smaller streams on the boundary, it is our judgment that such oxidizing process as intermittent sand filtration, and treatment by sprinkling filters, contact beds, and the like, are unnecessary, inasmuch as ample dilution in the lakes and large streams will provide sufficient oxygen for the ultimate destruction of the organic matter.

In the system you are proposing to adopt, is this principle provided for?

Dr. BURKHART. We have not come to that yet; we are waiting to hear. We have not arrived at any plan yet. The board will hear from the sanitary engineer what he proposes, but I can say is practically the sense of the board. That is their individual opinion.

Mr. CASGRAIN. Who compose the Michigan State board of health?

Dr. BURKHART. It is composed of seven members from the State of Michigan, one layman and six medical men, and myself.

Mr. CASGRAIN. I suppose that is an elective board?

Mr. BURKHART. It is appointed by the examiner for overlapping periods of six years each.

Mr. POWELL. The personnel does not change at the one time?

Dr. BURKHART. No, sir; the personnel never changes entirely.

Mr. GARDNER. How long has it been in existence?

Dr. BURKHART. A great many years. Dr. Baker was the originator of it. It is over 30 years in existence.

Mr. POWELL. In your studies, and in thinking over the questions involved, what is your own opinion as to what would be the proper thing to do with respect to cities like Detroit and Buffalo?

Dr. BURKHART. To prohibit all raw sewage from being deposited in the river.

Mr. POWELL. Would you go that far?

Dr. BURKHART. Yes, sir; more radical than that, but I do not wish to say it.

Mr. POWELL. How far do you go?

Dr. BURKHART. As far as I can.

Mr. POWELL. Make it as pure as possible.

Dr. BURKHART. As pure as possible. There has not been anything said that is too radical for my views.

Mr. CASGRAIN. I see that your board would concur in the sixth paragraph of the summary of the report of our engineers. It reads:

6. While realizing that in certain cases the discharge of crude sewage into the boundary waters may be without danger, it is our judgment that effective sanitary administration requires the adoption of the general policy that no untreated sewage from cities or towns shall be discharged into the boundary waters.

Dr. BURKHART. That is absolutely correct.

Mr. POWELL. Mr. Casgrain asked you what your opinion was or what your recommendation would be as to the treatment that you would prescribe.

Dr. BURKHART. I am not prepared to give you that. I don't think I am competent to say what treatment I would prescribe. The

screening method, of course, is good, but it is not as effective as a combined system of screening and sedimentation. The screening method will, to a great extent, do away with pollution, but it stands to reason that it can not do it perfectly. There is only one way to do it, and that is a radical method.

Mr. POWELL. What about sedimentation?

Dr. BURKHART. You have that to look out for also.

Mr. POWELL. That, in your judgment, would be more effective than screening?

Dr. BURKHART. I would not like to say that it would or that it would not. I do not feel that I am competent to give you an opinion as to the methods.

Mr. TAWNEY. What has been the attitude of the municipalities on the lake shore and along the river under your jurisdiction towards your regulations and administration of the public health laws of this State?

Dr. BURKHART. They have responded very nobly, sir. In very few instances have they refused to obey the orders of the board; in two instances we have had to resort to the courts.

Mr. LAWSON. Do they do that in Detroit?

Dr. BURKHART. They have done very well. We have no complaint against the city.

Mr. LAWSON. What about the Highland Park order?

Dr. BURKHART. That is the one exception. That is in court now, and we have another case.

Mr. TAWNEY. What I wanted to know was what was the general attitude of the municipalities to the public health board of the State?

Dr. BURKHART. They obey instructions. We are careful not to impose any unnecessary obligations, and it is not our policy to exercise any arbitrary rule, except when it is absolutely necessary.

Mr. POWELL. Do the riparian communities below here complain very much?

Dr. BURKHART. They have complained; there are numerous complaints upon file.

Mr. CASGRAIN. Have you had any complaints from the municipalities on the other side of the river?

Dr. BURKHART. No; our board has never received a complaint from them.

Mr. POWELL. I suppose your board is not the channel through which these complaints from across the river would come?

Dr. BURKHART. I think not.

(Edward D. Rich, sanitary engineer of the State board of health, was then called.)

Mr. TAWNEY. The secretary of your board, who has just preceded you, stated that you had in contemplation or in preparation some general plan for the treatment of the sewage of the cities along Lake Huron and the Detroit River. Will you give the commission such information as you have, from the investigations that you have made, and also in respect to any plans you now contemplate proposing to the board of health.

Mr. RICH. As Dr. Burkhardt has stated, this matter is really in its infancy. The law giving us control over the waterworks and

sewerage systems of the State went into effect August 15, 1913, so that we have really had but a little over a year to deal with it. The law, as you will see, provides that each municipality shall file with the State board of health descriptions and plans of its water-supply and sewerage systems. The same law created the office of State sanitary engineer. Very much of our time since the law went into effect and the office created has been taken up with clerical details and getting in the facts. A great amount of work has been necessary to deal with that, and a great many maps have not come in yet, for various reasons, mostly good reasons. We have had but very little chance thus far to consider what we shall propose. The work will be taken up as soon as we possibly can. This summer has been a very busy one in answering questions, for assistance of various kinds, all over the State, and we have been advising the people about it as well as we can. About 70 different questions were taken up in one quarter, from April to July, which will give you an idea of the work done. As soon as we can get a little relief from this we will go over the plans that have come in and examine each one carefully, and see if there is anything requiring immediate attention with regard to water or sewerage. We then propose to go to the cities in question and confer with them and present to them our views of what should be done, and see what they propose to do, or what they think best ought to be done, and how they are situated for carrying it out.

If it becomes necessary to invoke the aid of the law in ordering changes, we will do that only as a last resort. We have had a few such things as that come up already, and in the case of one small municipality in the State we had the board issue an order to make certain changes in their sewerage system. We find that most of the cities are very much in sympathy with improvements along these lines. The chief difficulty seems to be in their providing the money or being able to finance it. That is the plan we have at present. We do not think we are justified now in saying what we propose to do, and I doubt if any general scheme can be laid out right away. It may be that a general plan, covering most of the municipalities in the State, would be desirable at some time when we understand more thoroughly what the needs of each problem are. I think perhaps Dr. Burkhart has given you a pretty good idea as to what the sense of the board is with regard to discharging crude sewage into the streams. We feel there has been a great deal of that sort of thing done that ought not to have been done, and we find that the cities are of the same opinion. There is really a very healthy sentiment growing up throughout the municipalities on that subject. It is very gratifying to us that the people should study this question, and that they are beginning to understand that they should, and are willing to proceed along right lines, though they may not have the cash. That covers what our intentions are.

Mr. CASGRAIN. I suppose you have read this summary of the findings of the sanitary engineers, which were given to us in New York in July last?

Mr. RICH. I have not had the privilege of seeing these, but I have heard them discussed at the hearings here.

Mr. CASGRAIN. The State board must have a copy of this?

Mr. RICH. We had a copy of it, but it got lost somewhere.

Mr. CASGRAIN. I will read the sixth paragraph of that report. It says:

6. While realizing that in certain cases the discharge of crude sewage into the boundary waters may be without danger, it is our judgment that effective sanitary administration requires the adoption of the general policy that no untreated sewage from cities or towns shall be discharged into the boundary waters.

Do you agree with that?

Mr. RICH. I do, with the exception that I think it is understood by the engineers that whatever small amount of crude sewage may be hereafter in a stream of water at times of storm and allowed to overflow into the stream, highly diluted, should be excepted in the general term of sewage. I think that is perhaps understood.

Mr. CASGRAIN. What is your opinion of the ninth paragraph of this summary report of the sanitary engineers, which reads:

9. In general, no more elaborate method of sewage treatment should be required than the removal of the suspended solids by fine screening or by sedimentation, or both, followed by chemical disinfection or sterilization of the clarified sewage. Except in the case of some of the smaller streams on the boundary, it is our judgment that such oxidizing processes as intermittent sand filtration and treatment by sprinkling filters, contact beds, and the like are unnecessary, inasmuch as ample dilution in the lakes and large streams will provide sufficient oxygen for the ultimate destruction of the organic matter.

I do not mean to say that would be the plan you have evolved as to the treatment of sewage in a general way, because you say you have not yet evolved any plan, but the sewage would be treated for pollution by screening or sedimentation, followed by chemical disinfection or sterilization.

Mr. RICH. I would think that the method of treatment should affect each case and not be a general rule. It might be that in the case of one city discharging its sewage into the river treatment for the elimination and prevention of nuisance would be all that would be necessary, whereas if a water supply were involved the question would be widely different. It would then resolve itself into the case of reducing the pollution to such extent that the water of the stream should be purified for the municipality below so that it should be perfect.

Mr. CASGRAIN. On the one hand you would have treatment of sewage, and on the other hand purification for drinking water.

Mr. RICH. I believe that would be necessary in almost every case.

Mr. POWELL. What would be your view with respect to agricultural communities such as you have along the Detroit River? Would you pay any attention to them?

Mr. RICH. Do you mean as to their effect upon the pollution of the stream?

Mr. POWELL. What would you do with respect to purifying the sewage of communities like Detroit, in view of the rights of the smaller communities for domestic purposes and for farm purposes?

Mr. RICH. It would seem to be unjust to compel as great an expense as that would be for the benefit of just a few people, although perhaps the doctrine of riparian rights would give them the right to expect that. It seems to me it would be an overbalanced sort of adjustment of it. I think all that would be necessary would be treatment sufficient to prevent nuisance.

Mr. POWELL. That would be your view of that?

Mr. RICH. Yes; and that they should look elsewhere for their drinking water.

Mr. POWELL. I suppose the whole fishing industry of the Detroit River is destroyed by pouring in this enormous amount of polluted water?

Mr. CASGRAIN. Some fish thrive on sewage.

Mr. RICH. I would not be prepared to say what the effect of sewage upon fish would be. It is well known among sanitarians that the effect of sewage on oysters is very dangerous to the public health.

Mr. POWELL. What would your view be as to what should be adopted in the case of communities such as Buffalo and Detroit, with respect to safeguarding the interests of the lower riparian communities?

Mr. RICH. That question is largely an economic one; at least the economics of the problem enter into it to a great extent.

Mr. POWELL. You can not ignore the economic aspect anywhere.

Mr. RICH. I do not think so, because the cost involved is heavy. It seems to me it would be almost impossible to purify the Detroit River to a point where it would be a safe drinking water for the municipalities farther down the stream; that is, within reasonable cost.

Mr. POWELL. The idea of these experts is to divide the burden—a certain amount would be borne by Detroit and the communities upstream; that is, that they would purify it to a certain extent, and then it would be purified for drinking purposes by the communities below.

Mr. RICH. It seems to me that would be a just division of the expense.

Mr. POWELL. You would agree with that?

Mr. RICH. I would; yes, sir. That would depend largely upon the kind of water in the stream, and should be determined by bacteriological tests rather than by opinion. Mr. Fuller, in a recent article, has proposed a standard of bacteriological purification for raw water going to the filters; it is rather a rough rule of 500 colon bacilli per 100 cubic centimeters in the raw water going to the filters. I believe that in a general way that ought to be purifiable to such an extent as to be satisfactory.

Mr. CASGRAIN. In view of the testimony you have given, Mr. Rich, it is important for us to have something about your qualifications. I see you are perfectly qualified, of course, but for our reference, and to sustain any opinion which we may give hereafter, I would like you to tell us what is your experience as a sanitary engineer.

Mr. RICH. I have been doing work with the State board of health in Michigan since 1911. I graduated from the Rensselaer Polytechnic Institute in New York in 1895 and have practiced my profession ever since. I was five years a member of the faculty of the University of Michigan as assistant professor and civil engineer and sanitary and municipal engineering. I was city engineer of Summit, N. J., for four years and deputy city engineer of Utica, N. Y., for six years.

Mr. TAWNEY. Has your department of the State board of health given any consideration whatever to the question of the pollution of the waters of the Detroit River, by the city of Detroit, in so far as it was an international problem?

Mr. RICH. I think not.

Mr. TAWNEY. Your consideration of the subject has been with reference to the effect upon the communities below, where the sewage is disposed of, by dumping it into the river on the Michigan side?

Mr. RICH. We feel that is our first duty, although we would be glad to interest ourselves in the other question also.

Mr. CASGRAIN. Something has been said about the fish in the river. I remember a time when the Detroit River was very rich in fish. The fisheries on the other side of the river were very productive and the people there drew considerable revenue from the whitefish. Do you know whether or not the dumping of sewage from the city of Detroit into the river would interfere with that industry, and whether it would have any deleterious effect upon the fish?

Mr. RICH. I can not say; I do not know.

Mr. CASGRAIN. I notice that the fisheries in this river have decreased tremendously in the last 25 or 30 years.

Mr. RICH. I may say that we have had trouble in one or two places from the fact of the fish dying, because of the effect of organic matter being put into the stream, to the extent of exhausting the oxygen, and the fish smother. That was with reference to a sugar factory, but that would not be the case here.

Mr. LAWSON (city solicitor). I would ask that the commission should hear Alderman Vernor, who has been connected with the city government for a quarter of a century and who has lived here for half a century.

Mr. TAWNEY. We shall be very glad to hear Alderman Vernor. Mr. Lawson, would you send to us a copy of the last financial statement of the city of Detroit; could you furnish a copy for each member of the commission and one for each secretary?

Mr. LAWSON. I shall see that that will be done.

Alderman JAMES VERNOR (of the city of Detroit). I can not give any testimony from an expert standpoint, but as an old citizen I can give some information that may be of value. I have seen the city grow from infancy up; and all of that time I may say we have got to a stage where it becomes necessary for us to take up the question of sanitation by reason of the inflow of sewage into the Detroit River. We do not consider it an international question, we consider it simply a city question, because the push of the water in the Detroit River, owing to the fact that our city takes the larger end of the bend, keeps our sewage on our own side of the stream.

Mr. TAWNEY. You are not speaking now from any bacteriological examination of the water which is made?

Alderman VERNOR. I do not doubt at all that the water is polluted in every inch of the Detroit River, but I do doubt that the Detroit sewage pollutes it beyond the center. I think you will find that Walkerville, Windsor, and Sandwich have much to do with the pollution you found below the city of Detroit on the other side.

Mr. POWELL. At Amherstburg there seems to be a series of cross currents.

Alderman VERNOR. That may be; but you will notice, if you take the law of the currents generally, that the whole push is toward the American shore.

Mr. POWELL. That is the general trend of the water.

Alderman VERNOR. As it goes down the shore bends that way and the current is thrown to our side.

Mr. GLENN. Would not high winds carry it across sometimes?

Alderman VERNOR. That possibly may be true, and I suppose steamers would carry it across, too. We have typhoid epidemics even on steamers. I recall one on the steamer *North West*, on which my daughter was a passenger and where almost all of the passengers on the boat had typhoid. That boat passed through polluted water and took it up for drinking purposes. They took the passengers and 20 of the crew off at Duluth and sent them to the hospital. Some of the passengers were not stricken down with typhoid until they got as far as the Yellowstone Park, but it was traced to the steamer, and the company had to make good the damage. I may state that a great deal of our typhoid occurs in the fall of the year. I think the health officer will tell you that many cases are traceable to people who have been off on vacation and who bring the typhoid back with them. The typhoid, of course, is not entirely due to our water system. The State board of health has told you they are opposed to the dumping of sewage into the Detroit River, and yet, notwithstanding that fact, they have ordered the city to take the raw sewage of Highland Park and carry it through one of its sewers and dump it into the Detroit River, and the case is in the courts. We do not want any more raw sewage put through our sewers than we produce ourselves. If we ever have to treat our sewage, we do not want to be put to the expense of treating the sewage from some place else. Once that sewage is put in our sewers it never could be taken out, and if they were allowed to connect with us we would be obliged to take care of the results indefinitely and for all time to come.

My own personal view would be that the Government should take a hand in the situation. The water of Lake Huron is absolutely pure; and if an adequate aqueduct could be carried from Lake Huron and Lake Erie, supplying all the towns along there, they would get pure water.

Mr. CASGRAIN. They would not remedy the situation confronting us; you would have pure water here, but what about the other side of the river? You doubt whether the sewage from Detroit pollutes the stream on the other side. We find the river polluted all over, and the pollution may come from Detroit, or Windsor, or Walkerville, but the situation which confronts us is, whether or not the sewage which comes down one side is instrumental and injurious to the health and property on the other side. That is the only question we have to deal with.

Alderman VERNOR. I have no objection to getting this pure-water supply I have spoken of and extending it over to the other side and making it an international waterway and furnishing water to the other side.

Mr. CASGRAIN. Excuse me for interrupting you.

Alderman VERNOR. I am glad to be interrupted, because I would like to have the situation made clear. I have personally been all through the sewerage system of Detroit. We had trouble with the contractors some years ago on the question of cement, and it became necessary to send a committee through the sewers. I tramped probably 10 miles through the sewers on the west side, where the work was

going on, and it was a revelation to me. There evidently was no occasion to screen the sewers, for there was not a thing inside in these sewers. You could not see a particle of paper, you could not see a particle of fecal matter. It was running about your feet like a mill race, and there was absolutely no odor, except in one instance where we went from one sewer to another sewer, a cross section, and there, when we got to the other end, we were unable to get out through the manhole, so we had to retrace our steps through that cross section, and then we found that we had stirred up considerable sedimentation that had lain dormant in that section, due to the fact that the current was not swift enough. The connecting sewers should be connected at such an angle that they should carry a portion of the water with them and not rely entirely on floods to carry it out.

Mr. GLENN. Would not that aqueduct system you speak of be very costly?

Alderman VERNOR. Yes, sir.

Mr. GLENN. Would not the cost be almost prohibitory?

Alderman VERNOR. Any work that would be carried on by the National Government for the health of the community would not be too costly. That is my own opinion.

Mr. GLENN. You think the Government ought to be required to remedy the pollution of the cities along the river?

Alderman VERNOR. The Government should finance the work, and the cities and the State should help it out. I do not think the pollution into Lake Erie would amount to anything if it was all taken in there. Before it got to another town the water would be free from the colon bacilli. In the ways and means committee, of which I happen to be chairman, we have considerable discussion of water supply, and we have also considered the question of sewerage, and it seems that a cross sewer at the bottom of the other sewers is about the only solution of it. That is almost as expensive as your water aqueduct. It is a pretty expensive proposition to build that, and then, after that is done, if you still consider that the dumping of the sewage into Lake Erie would be detrimental you would have to add the extra expense of treating that sewage.

Mr. GLENN. You would have to treat the sewage if you had an aqueduct?

Alderman VERNOR. I should say not; I should say raw sewage dumped into Lake Erie would do no harm. The volume of water in Lake Erie would so dilute it that the distance it traveled before it was used again would clear it. From all I have been able to learn of the action of water on colon bacilli, I think that would be the case.

Mr. POWELL. There is one fact which I would bring to your notice. The investigation, which was thorough and elaborate, made by the commission, has revealed the fact that the waters of Lake Huron, instead of being absolutely pure as you suppose, are not pure during the navigation season, whatever they may be in winter. They are not, during the navigation season, sufficiently pure to be a good source of raw water supply.

Alderman VERNOR. I do not know where the test was taken from, but if it was taken out at a proper point in Lake Huron, where the end of the aqueduct would come, I doubt if you would find anything

injurious there. Dr. McLaughlin and his staff are responsible for the figures. Doctor, what about that?

Dr. McLAUGHLIN. I would suggest that Mr. Vernor should be asked on what he bases his opinion.

Mr. POWELL. Your statement with regard to the water is correct!

Dr. McLAUGHLIN. Yes, during the season of navigation it is not safe drinking water without purification.

Alderman VERNOR. I have lived a long while and I have drunk the Detroit River water all my life, and I have no fear of it as Detroit River water to-day.

Mr. POWELL. The population on the Lakes is increasing with tremendous rapidity.

Alderman VERNOR. I admit that, but I think you will find that the State board of health will agree that if we all drank Lake Huron water we would be free from typhoid. I am talking now of the lake water, pure and simple. I told you when I started out that I was not an expert but that I would give you my own opinion and the opinion of the laymen with whom I come in contact.

Mr. POWELL. The result of these examinations goes further than that. It is found that, so far as the tracks of the vessels across Lake Huron and the other lakes as well are concerned, it is not a fit source of water supply without purification.

Alderman VERNOR. I think myself that vessels should be compelled to take pure water supplies and to take care of their refuse. I think that is all I have to say.

Mr. LEISEN. That closes the testimony for Detroit, Mr. Chairman.

The CHAIRMAN. Are there any representatives from the towns or cities below Detroit on the American side who wish to be heard?

STATMENT OF MR. CHARLES GARDNER, OF WYANDOTTE, MICH.

The CHAIRMAN. Mr. Gardner, I believe you represent the city of Wyandotte?

Mr. GARDNER. I am one of the commissioners of Wyandotte. The mayor is away at the present time, so I came up. I came yesterday and by mistake went to the Federal building, where I understood the meeting was to be held.

Mr. CASGRAIN. Is Wyandotte a city or a town?

Mr. GARDNER. It is a city with a commission form of government.

Mr. CASGRAIN. You have no council?

Mr. GARDNER. No, sir; we have a mayor and four commissioners.

Mr. CASGRAIN. I think that is the proper way to administer a municipality.

The CHAIRMAN. Mr. Gardner, your city received the same notice that was sent to the other cities with respect to the meeting of the International Joint Commission here at Detroit?

Mr. GARDNER. Yes; the mayor received some communication.

Mr. CASGRAIN. When I made the remark that I did just a moment ago I was not reflecting on any American city. I was considering only what happens in our own cities and some of our municipalities.

Mr. GARDNER. That is all right; it sounded pretty good to me, anyway.

The CHAIRMAN. What is your system at Wyandotte with respect to your water supply and sewage disposal?

Mr. GARDNER. We pump the water out of the river. The intake is at the waterworks station, and we treat the water with chlorine and have been doing so for about six months.

The CHAIRMAN. Your sewer pipes discharge into the river below Wyandotte?

Mr. GARDNER. Yes, sir.

The CHAIRMAN. What amount of water do you consume daily?

Mr. GARDNER. We pump about 3,000,000 gallons a day.

The CHAIRMAN. What amount of sewage is disposed of there—how many gallons?

Mr. GARDNER. I could not answer that question.

The CHAIRMAN. What is the population of Wyandotte?

Mr. GARDNER. About 12,000.

The CHAIRMAN. You do not treat your sewage at all, do you?

Mr. GARDNER. Not the sewage; no, sir.

The CHAIRMAN. What towns or cities are below you on the Detroit River?

Mr. GARDNER. Trenton is the only town until you get down to Monroe.

The CHAIRMAN. How far is Trenton below Wyandotte?

Mr. GARDNER. About 4 miles.

The CHAIRMAN. It has its intake or water supply in the Detroit River, also, has it?

Mr. GARDNER. Yes, sir.

The CHAIRMAN. Are they purifying their water?

Mr. GARDNER. I do not think so. I could not say positively, however.

The CHAIRMAN. Their sewer pipes discharge into the Detroit River, also, do they?

Mr. GARDNER. Yes, sir; they discharge into the Detroit River, also.

Mr. GLENN. In what condition did you find your water at the intake before you purified it?

Mr. GARDNER. We sent samples to the State board of health, and they announced it as unfit for domestic use. We took samples at different times at various places in the river, and, of course, they had the same result as far as that is concerned, but since we have been using the chlorine they have announced it practically safe for domestic use.

Mr. GLENN. But it was in such a condition before you treated it that you could not possibly use it without seriously injuring the health of the citizens?

Mr. GARDNER. Well, they did use it. Everybody used it.

Mr. GLENN. Before you commenced treating it?

Mr. GARDNER. Yes, sir.

Mr. GLENN. What effect did it have on the health of the community?

Mr. GARDNER. Well, Wyandotte is a pretty healthy town.

Mr. GLENN. With regard to the health of the community, has there been any difference since you have been treating the water?

Mr. GARDNER. We have less contagious diseases now than before. The town has been pretty free from typhoid fever for the last year, so far as that is concerned.

The CHAIRMAN. How far is Wyandotte below Detroit?

Mr. GARDNER. It is about 12 miles by water.

The CHAIRMAN. Are there any cities between Detroit and Wyandotte on the Canadian side?

Mr. GARDNER. Yes, sir; there is Amherstburg across here, and there are also Windsor and Gordon.

The CHAIRMAN. What is the population of those three cities, Amherstburg, Windsor, and Gordon?

Mr. GARDNER. I do not know the population of those cities.

The CHAIRMAN. Their sewerage systems also discharge into the Detroit River, do they not?

Mr. GARDNER. I think they do, but I could not say positively.

Mr. MAGRATH. Are you satisfied with the present condition in the Detroit River?

Mr. GARDNER. No.

Mr. MAGRATH. What have you to say about that?

Mr. GARDNER. I do not know that I have anything to say in particular. We are below Detroit and, of course, anybody can naturally see that we are not getting the best water there. What would be the best way to remedy that condition is what we are trying to learn. It would place a burden upon Wyandotte to change its sewerage system to some system different from what it has at the present time. The population is getting greater all the time, and naturally the water conditions are not getting any better.

Mr. CASGRAIN. What effect does this chlorination have upon the taste of the water?

Mr. GARDNER. When we first started to use it the people objected to it, and I think there was some complaint about it, but at that time there was something emptied into the Detroit River that came periodically, about once a week, and we have never been able to trace where it came from. Once or twice—on one Sunday in particular—the taste of the water was so bad that it spoiled everything that they tried to cook with it, but that came from some manufacturing concern along the Detroit River. As I say, we have been unable to find where it came from. Since we have been using the chlorine nobody detects the taste. We are using it in an automatic way. We have a sort of an automatic arrangement to insert just so much for every revolution of the pump, and we are very careful about the amount that we use.

The CHAIRMAN. In what proportion do you use it?

Mr. GARDNER. I think they are using from $7\frac{1}{2}$ to 8 pounds at the present time.

The CHAIRMAN. To how much water?

Mr. GARDNER. To a million gallons, I think.

The CHAIRMAN. What is the assessed valuation of Wyandotte?

Mr. GARDNER. About \$6,000,000.

The CHAIRMAN. What is your rate of taxation?

Mr. GARDNER. \$1.14 per thousand for city taxes alone.

The CHAIRMAN. That is your municipal tax alone?

Mr. GARDNER. The municipal tax alone; yes, sir.

The CHAIRMAN. What is your indebtedness?

Mr. GARDNER. About \$340,000 to \$350,000.

The CHAIRMAN. Is there a limit on the amount of indebtedness that you can incur?

Mr. GARDNER. We are bonding now for \$40,000 and are going to vote on \$85,000 more bonds. That will pretty near bring us up to the limit.

The CHAIRMAN. What is the limit?

Mr. GARDNER. I do not know what it is at the present time.

The CHAIRMAN. Has the commission power to vote indebtedness up to a certain maximum?

Mr. GARDNER. The commission has not that power. That is done by the State, of course. We can only bond for a certain amount, but just what that amount is I do not know myself.

The CHAIRMAN. Generally municipalities have a discretionary range within which they can work.

Mr. GARDNER. We have not.

The CHAIRMAN. I understood Mr. Lawson to say that was the case here in Detroit, and I understood it was a State law.

Mr. GARDNER. Yes; it is a State law.

The CHAIRMAN. Your total indebtedness, with the amount that you are now about to vote, will be about how much?

Mr. GARDNER. About \$465,000.

The CHAIRMAN. What is the purpose of the bonds which you are about to vote?

Mr. GARDNER. We are voting \$40,000. That has been carried, and the bonds have been approved. That amount is for waterworks and electric-light extension. The other \$85,000 is for pavement improvements and other general improvements.

Mr. POWELL. Do you publish annually a financial statement?

Mr. GARDNER. Yes, sir.

Mr. POWELL. Could you supply us with copies of such statements?

Mr. GARDNER. Yes, sir.

Mr. GLENN. How long have you been treating your water, Mr. Gardner?

Mr. GARDNER. Five or six months.

Mr. GLENN. Was not that treatment brought about by the report of the sanitary engineers as to the conditions above; that it ought to be treated or your health would be endangered?

Mr. GARDNER. Yes. There have been always a lot of complaints. Everybody knew of the condition of the water at Wyandotte. Some time ago I wrote to the State board of health for information as to the best way to treat the water, and they sent a representative to Wyandotte. I think Mr. Rich came to Wyandotte at the time to fix us up, and we commenced treating the water at that time.

Mr. GLENN. Did you make any change at your intake except treating the water?

Mr. GARDNER. No, sir.

Mr. MAGRATH. How do you determine the proportion of the chemicals to be used?

Mr. GARDNER. The State board of health does that.

Mr. GLENN. Did not your town vote on a filtration plant?

Mr. GARDNER. Some time ago the agitation was up, but I do not remember now whether it came to a vote or not. I guess it did at that time. It was defeated, nevertheless. That was five or six years ago.

Mr. POWELL. Have you made a bacteriological examination of the water after it is chlorinated?

Mr. GARDNER. Yes. We sent samples of it to the State board of health after we commenced using chlorine.

Mr. POWELL. Are daily observations taken?

Mr. GARDNER. No, sir.

Mr. POWELL. How frequently are they taken?

Mr. GARDNER. Every two or three or three or four months. Just about the time that we were treating it we sent them oftener. We have done it since, and it seems to be all right in a general way.

Mr. POWELL. Unless it is screened the chlorination process is not very effective. The stronger the solution must be if the large solid particles remain in it.

Mr. GARDNER. We screen it, so far as that is concerned. We grind it all up and make it fine before we use it at all.

Mr. POWELL. Do you do that at your intake?

Mr. GARDNER. No; right in the building.

Mr. POWELL. You are talking about the chemical and I am speaking about the water. Unless you take out the solid particles it takes a much stronger solution to be effective.

Mr. GARDNER. Undoubtedly that is true.

Mr. POWELL. You still have a high typhoid fever rate, have you not?

Mr. GARDNER. No; we have not. It is very low and has been very low for the last year.

Mr. POWELL. Is it the feeling down there that Detroit should take care of its sewage to some extent?

Mr. GARDNER. Yes; it is.

Mr. POWELL. That sentiment prevails there?

Mr. GARDNER. That sentiment prevails there.

Mr. POWELL. And has it voiced itself in any agitation at all or any resolutions by your commission?

Mr. GARDNER. No; it has not.

Mr. POWELL. But still it is there?

Mr. GARDNER. Yes, sir.

Mr. CASGRAIN. It is the general feeling of the community?

Mr. GARDNER. Yes, sir.

The CHAIRMAN. We are very much obliged to you, Mr. Gardner, for the views that you have presented to the commission. Have any of the other towns or cities below Detroit on the American side any representatives present? If not, unless the city of Detroit desires to present something further, the hearings will be closed so far as Detroit is concerned. Is there anything further, Dr. Price, that you have to offer?

Dr. PRICE. I would like to ask Dr. McLaughlin just a few questions relative to these matters.

In making these investigations, Dr. McLaughlin, and taking the samples, for instance, at a place which is known in the report as a cross section, were those sites for taking samples about equally distant apart across the channel?

Dr. McLAUGHLIN. Yes; as a rule.

Dr. PRICE. So as to get a general average across the channel?

Dr. McLAUGHLIN. Yes.

Dr. PRICE. I want to ask if the commission has scientific proof that the pollution from one side does cross the channel to the detriment of health on the other side. I do not want to be understood as working against better health. I am very much interested in it. But in order that that might be cleared up, is there scientific proof that the pollution from one side crosses the channel to the detriment of the health of the inhabitants on the other side?

Dr. McLAUGHLIN. Yes; beyond all reasonable doubt. Of course, you must realize as a medical and scientific man that the colon bacillus has no label or bell on it, and when we find it we can not say positively whether it comes from Windsor or Detroit. However, you can trace the pollution until it crosses the international boundary. Furthermore, while the bulk of the Detroit sewage goes through the Wyandotte channel, there is no question that a great portion of it is split by the edge of Grosse Isle and gradually spread out fanlike until it may even reach the Amherstburg shore.

Dr. PRICE. I am unable to find that.

Dr. McLAUGHLIN. It is there and you will find it if you look for it patiently.

Dr. PRICE. I have a little chart here.

Dr. McLAUGHLIN. I do not think we ought to take up the time of the commission to show it, but I can show it.

Dr. PRICE. I would like to arrive at some conclusive report. This is very important and we do not want to take an expensive step until all the steps approaching it are led up to. Now, taking this chart of the Detroit River and assuming that the samples are taken equally distant apart in the cross section, I am unable to find during the course of the Detroit River anywhere near the center a place where the samples at all places across the river exceed that arbitrary standard adopted by the engineers of 500 bacteria per 100 cubic centimeters. For instance, it greatly exceeds that toward either shore, and something must be done, as it is a bad state of affairs, but as far as one side of the river polluting the other side of the river is concerned, I am unable to find at any place during the course of the Detroit River, near the center, a place where the number of *B. coli* exceeding 500 per 100 cubic centimeters exists.

Dr. McLAUGHLIN. It is all the way through it. Did you look at the section at the mouth of the Detroit River?

Dr. PRICE. Yes, sir; down to Lake Erie.

Dr. McLAUGHLIN. Look at it more closely and you will find it is over 500.

Dr. PRICE. For instance, these outline different cross sections, do they not?

Dr. McLAUGHLIN. Yes.

Dr. PRICE. Where does the number of *B. coli* exceeding 500 per 100 cubic centimeters exist clear across the Detroit River?

Dr. McLAUGHLIN. These sections are here in the upper river where the pollution is still hugging the shore.

Dr. PRICE. Coming down to Amherstburg, which has often been spoken of, just where is there a cross section where at all points an excess of *B. coli* extends completely across the river?

Mr. CASGRAIN. What is the page of the progress report which you are now referring to?

Dr. PRICE. This is plate No. 13, which faces page No. 38 of the report.

Dr. McLAUGHLIN. You will find that in this cross section at the mouth of the river the pollution starting from the American shore runs 24,400, 34,300, 23,500, 24,310, 2,620, 2,620, 1,720 at the boundary line, and 1,630 for the section beyond the boundary line. That is in Canadian water. Then it falls to 361 and 460, which are slightly under 500, but still a very serious pollution.

Mr. CASGRAIN. What part of this plate are you reading from now? Where is that situated; is it the last column?

Dr. McLAUGHLIN. It is shown on plate No. 13, starting with sample point No. 264 and running to sample point No. 273 in red letters. There the pollution clearly runs across the boundary. The standard of 500 B. coli was considered as a maximum by most of the engineers. It should not be worse than that. There was a considerable difference of opinion as to whether that was stringent enough to assure a good raw water for a waterworks plant. However, they wanted to be lenient and they were all willing to agree that it should not be worse than that.

Mr. POWELL. That was the standard of the burden to be thrown upon the purification plant?

Dr. McLAUGHLIN. Yes, sir.

Mr. POWELL. That does not mean that that is drinking water by any means.

Dr. PRICE. Of course, we have not followed this matter as closely as you gentlemen have. I would not throw anything in the way of sanitary reform, but as I understand it is the idea at present of the commission that anything below that may reasonably be considered as better chemically taken care of by a filtration plant than by a sewage-purification plant?

The CHAIRMAN. So far as the commission is concerned, I do not think there is anybody that is authorized to state that it has reached any conclusion whatever as to the load that can reasonably be placed upon the water-purification plant below a sewage-disposal plant. The opinion was given to the commission by Mr. Fuller that anything above 500 B. coli per 100 cubic centimeters would be an unreasonable load to impose upon a water-purification plant; but so far as agreeing upon what the standard should be, the commission has not reached any conclusion yet at all.

Dr. PRICE. But that is a kind of working average that is comparative.

The CHAIRMAN. We are working along in order to get the judgment of the experts representing the municipalities, and ultimately, I suppose, the commission, when it reaches a final conclusion, will have to conclude as to what the maximum load should be. I do not know what the commission may agree upon at all.

Dr. PRICE. That is a relative working standard that is tentative, anyway.

Dr. McLAUGHLIN. That is one that has been suggested.

Mr. POWELL. We must not confuse the two questions. In the first place we are asked to inquire whether any pollution has extended across the boundary line. If you will look at the chart you will see that although there is not indicated there a pollution of

500 at that particular point on the Canadian side to which you are calling Dr. McLaughlin's attention, yet it is not a potable water in its raw condition. If the case were reversed and the Canadians were doing it on their side, there would be a burden thrown upon a purification plant in the United States.

Dr. PRICE. But, pursuing that further, as you approach the Canadian shore that same cross-section figure increases.

Dr. McLAUGHLIN. There is a slight increase from 361 to 460 on the Canadian shore. You are referring to the last two sample points, are you not?

Dr. PRICE. Yes. Then the city of Amherstburg evidently pollutes the water to a very slight extent immediately below Amherstburg?

Dr. McLAUGHLIN. Undoubtedly.

Dr. PRICE. What conclusion would you draw from that fact—that a city the size of Amherstburg pollutes it practically not at all? Would it be reasonable to conclude, as Alderman Vernor has said, that the current is across toward the American shore? Would you consider that a reasonable conclusion?

Dr. McLAUGHLIN. No; I would not. It seems to me that the figures indicate a setting of the current toward the Canadian shore in that part of the river. The slight advance of Amherstburg pollution from the shore toward the boundary line is reasonable and to be expected. Pollution thrown into a large stream as dilution takes place becomes less intense and more diffuse. That is the law and that is just what takes place here. It spreads out rather fan shape and becomes less intense until it ultimately disappears. The two mingle here [indicating]. When you get to a certain point it is quite impossible to say whether the *B. coli* come from Detroit or from the Canadian side.

Dr. PRICE. Above that one particular place below which there is no community of any size that is operating waterworks there is a distinct line toward the boundary line, arbitrarily considered, of purer water than at either side. That is true, is it not?

Dr. McLAUGHLIN. That is true.

Dr. PRICE. Would not that seem to indicate that the pollution from one side did not materially approach the other side of the river?

Dr. McLAUGHLIN. No; it is a much more complex question than that. You have the question of vertical stratification and horizontal stratification. You do not get a complete mixing, but you get a cross current by which the pollution is carried rapidly through the stream without a thorough mixing of the whole body of water.

Dr. PRICE. But with the series of analyses that you made and the great amount of work that you put in the investigation would you not have determined that in some of these places it had been existing to a great degree?

Dr. McLAUGHLIN. I do not understand your question.

Dr. PRICE. Perhaps I can show it clearer with this chart. It is diagrammatic purely. The American side is represented by a comparatively straight line, as is also the Canadian side. The green lines mostly on the Canadian side indicate the points toward the American side where the pollution is greater than 500 bacteria per 100 cubic centimeters, according to these reports. The districts

wherein the pollution is just equal to 500, or this tentative standard, are indicated in yellow, and where the pollution is less than 50 per 100 cubic centimeters they are indicated in red. As we go down the Detroit River I am unable to find any place where samples exceeding 500 colon bacilli per 100 cubic centimeters exist.

Mr. GLENN. Did you notice the figures 1630 across the line there?

Dr. PRICE. I mean pretty close to the other shore.

Mr. GLENN. That is across the line, though.

Dr. McLAUGHLIN. I would like to have an opportunity to answer Dr. Price. So far there has been only a series of questions.

The CHAIRMAN. This diagram that you are now exhibiting showing certain data was taken from the report of the sanitary experts, was it not?

Dr. PRICE. Yes, sir.

Mr. GLENN. Dr. Price, from the nature of your remarks and the questions you are asking Dr. McLaughlin, is it the purpose of your cross-examination to show that the International Joint Commission has no jurisdiction over this matter, and, consequently, it must be left to the State board of health?

Dr. PRICE. I have not any definite object.

Mr. GLENN. Could it be any other object than to show that we have no jurisdiction over the subject matter?

Dr. PRICE. It was not a premeditated purpose.

Dr. McLAUGHLIN. It was as suggested by Alderman Vernor.

Dr. PRICE. It is only to bring out all matters bearing on the question.

Dr. McLAUGHLIN. I would like to say in reply to Dr. Price's statement that I think his chart is made with accuracy—it is a reasonable presentation of the facts; but I would like to call attention to one or two things. First, there is no assurance that the International Joint Commission will regard a pollution of 100 B. coli per 100 cubic centimeters in the light of harmless pollution or that they will permit a pollution of less than 500 to go on and not consider it a menace. In fact, the commission, I believe, has not fixed upon any standard as to what pollution is detrimental, and in the viewpoint of many sanitary experts and engineers a pollution of 500 is a raw water that will impose an unreasonable burden upon water-purification plants and would afford a small margin of safety.

The second point is that if this line which you have drawn, and which covers the pollution greater than 500, prevented this question from becoming an international one, you are leaning upon a very slender reed, because it is based upon a season when water pollution was at its minimum. That condition may change at any time, and this which your yellow line brings across the international boundary—well across, but not quite to the Canadian shore—may at any time reach across upon any particular day. We have days when that maximum did reach across, but the average brought it down below 500. When we compiled our figures we had no idea as to what it would result in, but personally I believe that a raw water with an average of 500 B. coli is about the limit that a purification plant can stand, and it leaves a margin of safety that is too small.

Dr. PRICE. I would be very glad to take your opinion on it.

Dr. McLAUGHLIN. We have no doubt whatever that the pollution does cross from one side to the other, but, as I said in the beginning,

it is based upon reasonable scientific deductions from the information obtained, and we are absolutely unable to pick out a colon bacillus and say that it came from Detroit or Windsor. That would be quibbling.

Dr. PRICE. I am not quibbling. I thought you would have understood that without my telling you so, because I have said before that I have no wish whatever to interpose anything in the nature of an obstruction to sanitary reform. I am very much interested in it, and I appreciate the aid that your service has rendered to us. I appreciate the value that the investigation of this commission will have.

Dr. McLAUGHLIN. I might also say, Dr. Price, that in our results we give the pollution the benefit of the doubt. The pollution is undoubtedly worse than we found it, and Mr. Dallyn will bear me out in that statement. One reason that our results did not run into higher figures is that some of the dilutions were left off. Undoubtedly, if we had carried them out to the limit in all instances we would have had a higher rate of pollution in that cross section. But we were satisfied that that amount would show any reasonable man that the pollution did extend across the boundary and was a menace to the public health on both sides of the line.

Dr. PRICE. You came here, and you have made a report. I certainly did not follow you when you were doing it. I certainly want to know how you arrived at it. It involves a tremendous expense to the people. It would be a very untoward thing if every step were not exhausted before a conclusion is reached with regard to a solution for it, and that is what I wanted to bring up—that it seemed from your own figures that there was a reasonable doubt about it.

Mr. MAGRATH. Dr. Price, I think the commission is greatly indebted to you for the interest you have taken in this matter. I would like to ask you, though, if you regard the condition of the Detroit River as being injurious to health without taking into consideration the location of the pollution?

Dr. PRICE. Yes; I do.

Mr. MAGRATH. You do not read this fourth paragraph of the summary of the sanitary engineers as meaning that the water which contains 500 colon bacilli to 100 cubic centimeters is safe water, do you?

Dr. PRICE. To drink raw?

Mr. MAGRATH. Yes.

Dr. PRICE. Absolutely not. It is out of the question.

Mr. MAGRATH. They say that if it contains more colon bacilli than that it would be an unsafe load for a water purification plant.

Dr. PRICE. Exactly. Of course, so far as I have followed the session of this commission it has been very investigative, and as far as I have understood it there seemed to be a tentative idea, at least, that anything below a pollution of 500 B. coli to the 100 cubic centimeters was more economically and equally efficiently taken care of by filtration.

Mr. MAGRATH. The reason I asked you my question is this, and I believe I stand alone in the view that I hold: It is just as easy for the

citizens of one country to pass over into the waters of the other country as it is for the pollution from one country to pass over into the waters of the other country, and we must bear in mind that the citizens of Detroit have the same rights in the waters on the other side as the people on the other side of the boundary in connection with the great commerce that is going on in these waters; so if there were pollution on the other side of the boundary by Canada to the injury of the health of the people in Canada, that is just as injurious, in my mind, to the people of Detroit, who have equal rights with the people of Canada in these waters.

Dr. PRICE. Absolutely so.

Mr. CASGRAIN. I do not think Mr. Magrath is alone in that opinion. I also agree with him, Dr. Price, when he says that we are thankful to you for the interest you have taken in this matter, along with all the other city and State authorities.

Mr. POWELL. Dr. McLaughlin, as I understand this matter it is this: That the fixing of a standard of 500 colon bacilli is simply a standard, with a view of dividing the burden between the offender and the community that is offended against as to whether, from an economical standpoint, it would be cheaper for the lower community to purify the water that they consume than to have the upper community purify the whole output of sewage.

Dr. McLAUGHLIN. Yes; I think that was their idea.

Mr. POWELL. But that must not be confused with the question of contamination and pollution. Water will be polluted where it is not potable. That is correct, is it not?

Dr. McLAUGHLIN. That is correct.

Mr. POWELL. So that we must keep those two questions apart.

Dr. McLAUGHLIN. There is another question that comes in there. Personally, I believe that the 500 standard is set too high, that the margin of safety is too small, and that the proper standard comes somewhere between 100 B. coli per 100 cubic centimeters and 500 B. coli per 100 cubic centimeters. In some rivers, where it is almost impossible to remedy the pollution, we have had to accept a worse standard than that; but in this great waterway we have an opportunity of maintaining a better standard. Then it becomes a question of the economic feasibility of how much we can accomplish, and if we can get a standard of 250 for these waters it will be better than the standard of 500.

Mr. POWELL. Do you not recollect that Mr. Fuller was rather alone in that idea and the calculations that were made by Mr. Whipple reduced the number of bacilli considerably?

Dr. McLAUGHLIN. I think the consensus of opinion was that it would be better to approach 200 than 500.

Mr. POWELL. The standard of 500 is a limit upon which you all agree.

Dr. McLAUGHLIN. Yes; but it should not be worse than that.

The CHAIRMAN. Is there any other representative of Detroit that has anything to offer or who desires to be heard? If not, this hearing will be considered as closed. In making that announcement I desire, on behalf of the commission, to express to the mayor and city officials of the city of Detroit and also to the city officials of Wyandotte and the representatives of the State board of health the sincere

thanks of the commission for their very kind assistance and cooperation in the consideration and investigation of this subject as it relates to these cities and the pollution of the waters of the Detroit River. The agreement between Great Britain and the United States is not an agreement as to the number of *B. coli* that may be permitted to cross the boundary line. The agreement is that neither will permit the pollution of these waters on either side of the line to the injury of health or property on the other side. Now, in solving the problem or in making recommendations for remedies the commission may take into consideration compromises and may agree upon any standard that it may see fit. I do not say that that affects the international question at all, but, in any event, the commission desires to express the sincere thanks for the very kindly attitude that the city of Detroit and the State board of health and the city of Wyandotte have had toward the commission and its work in trying to solve this problem and also for the information that the members of the city council of the city of Detroit have furnished us.

The commission will stand adjourned to meet at Windsor, Ontario, to-morrow morning at 10 o'clock, in the city hall.

INTERNATIONAL JOINT COMMISSION,
Windsor, Ontario, Canada, Thursday, October 1, 1914.

The commission met in the city hall at 10 o'clock a. m.

Present: Th. Chase Casgrain, K. C. (presiding); James A. Tawney; Henry A. Powell, K. C.; Obadiah Gardner, Charles A. Magrath, and R. B. Glenn; Lawrence J. Burpee and Whitehead Kluttz, secretaries; and Dr. Allan J. McLaughlin and Prof. Earle B. Phelps, of the Public Health Service of the United States.

APPEARANCES.

Dr. F. Montizambert, representing the Dominion Government.

Mr. F. A. Dallyn, representing the provincial board of health of Ontario.

Mr. F. L. Howell, mayor of Windsor, Ontario.

Dr. H. R. Casgrain, chairman board of health of Windsor, Ontario.

Dr. G. R. Cruickshank, medical health officer of Windsor, Ontario.

Mr. M. E. Brian, city engineer of Windsor, Ontario.

Mr. William Hanrahan, chairman of the board of water commissioners of Windsor, Ontario.

Mr. C. M. Barber, civil engineer of Windsor, Ontario.

Mr. J. F. Smythe, water commissioner of Windsor, Ontario.

Dr. W. Fred Park, mayor of Amherstburg, Ontario.

Dr. T. James Park, medical health officer of Amherstburg, Ontario.

Mr. Owen McKay, city engineer of Walkerville, Ontario.

Mr. Harvey Howe, mayor of Walkerville, Ontario.

Dr. W. J. Beasley, of Sandwich, Ontario.

Capt. William Parker, superintendent of the Dominion fish hatcheries, of Sandwich, Ontario.

Mr. George H. Fenkell, commissioner of public works of Detroit, Mich.

The CHAIRMAN. Gentlemen, the commission will now come to order. I believe the best way to explain the object of this meeting is to read the letter which was sent to the mayor of Windsor and the municipal authorities of the different cities and towns on the bordering waters. The letter, which was sent out by the secretary of the International Joint Commission under date of August 20, is as follows:

The MAYOR, ———.

DEAR SIR: I am directed by the International Joint Commission to officially notify you as mayor of ——— that under the treaty between the United States and Great Britain signed at Washington, January 11, 1909, it is provided by Article IV as follows:

"It is further agreed that the waters herein defined as boundary waters and waters flowing across the boundary shall not be polluted on either side to the injury of health or property on the other."

On the complaint of the people living along these boundary waters that this provision of the treaty was being violated by certain municipalities, the Governments of the United States and Canada, on August 1, 1912, referred to the International Joint Commission, under Article IX of the treaty, for investigation and report. with its conclusions and recommendations, the following questions:

1. To what extent, and by what causes, and in what localities have the boundary waters between the United States and Canada been polluted so as to be injurious to the public health and unfit for domestic or other uses?

2. In what way or manner, whether by the construction and operation of suitable drainage canals or plants at convenient points or otherwise, is it possible and advisable to remedy and prevent the pollution of these waters, and by what means or arrangement can the proper construction or operation of remedial or preventive works, or a system or method of rendering these waters sanitary and suitable for domestic and other uses, be best secured and maintained. In order to secure the adequate protection and development of all interests involved on both sides of the boundary and to fulfill the obligations undertaken in Article IV of the waterways treaty of January 11, 1909?

In order to answer the questions set forth in the first branch of the above reference, an extensive field investigation to determine the origin, degree, and extent of the pollution of these boundary waters was carried out by the commission in 1913. The facts of pollution having been ascertained, as shown by the accompanying "Progress report," there remains for the commission in answering the second branch of the reference to investigate and determine what remedies should be recommended to the two Governments for the pollution found to exist and the means of applying and maintaining such remedies.

Under the plan adopted by the commission for the conduct of the investigation of the second branch of the foregoing reference, the following steps are deemed necessary:

1. Securing opinions from leading sanitary engineers upon questions relating to general policy and consultations with the sanitary engineers and sanitarians to be employed by the commission.

2. Hearings to enable all interested parties to present their views and facts as to what remedies they would advise and are capable of installing and maintaining, hearings to include any expert testimony submitted.

3. The collection of all available knowledge and data bearing upon the most approved methods of water purification and sewage treatment.

4. Formulation of advisable requirements for each locality according to local conditions and necessities as shown to exist as the result of the investigation by the commission, and the report of the sanitary experts on the pollution of the boundary waters between Canada and the United States.

Accordingly the commission has obtained the opinions of six eminent sanitary engineers, Messrs. George W. Fuller, Earl B. Phelps, and George C. Whipple for the United States, and Messrs. F. A. Dallyn, W. S. Lea, and Theo. J. Lafreniere for the Dominion of Canada.

The testimony of these experts established the broad fundamental principles upon which any remedial action must be based and indicated clearly the procedure which should be followed by the commission. The testimony, and a résumé of the fundamental principles agreed upon by the sanitary engineers, is herewith submitted.

The commission has now reached the very important step in the plan of procedure providing for hearings to enable municipalities, and all interested parties, to present their views and facts, including such expert testimony as they may desire to present as to what remedies they would advise, and are capable of installing and maintaining, that will prevent or remedy the pollution which now exists in contravention of the provisions of the treaty above referred to.

For the purpose of affording your city and its representatives an opportunity to be fully heard in respect to the prevention of, or remedies for, the pollution of the waters of the Detroit River by the discharge of the sewage of your city in said river, the International Joint Commission will meet in the city of Windsor, beginning at 10 a. m. on Thursday, October 1.

For the convenience of the commission it was suggested that in the meantime you select such representatives of your city as you may deem advisable to prepare and present such plans for sewage disposal or treatment as in their judgment would adequately meet the requirements of the foregoing treaty in respect to the pollution of said river.

For your convenience and use in preparing for this hearing I am sending you, under separate cover:

1. One copy of the treaty.
2. One copy of the Progress Report on Pollution of Boundary Waters, including the report of the sanitary experts, and
3. One copy of the testimony and résumé of the consulting sanitary engineers.

I have the honor to remain, with great respect,

Very truly, yours,

_____, SECRETARY.

Now, gentlemen, we have met here to-day to hear the representatives of the city of Windsor and the representatives of the other cities on this side of the line so that they may help the commission in coming to some decision in respect to the means which should be taken to remedy the pollution of the Detroit River. As this letter says, there is no doubt as to the fact of pollution; the Detroit River is polluted from one end to the other. We now ask that those who represent the different cities come to our help and advise us, as far as they can, as to what means should be taken to remedy this pollution.

I would like to call your attention to this fact, that under the reference the commission can make no decision. There are certain questions which when referred to or brought before the commission under the terms of the treaty the commission may decide finally, but in this case under article 9 of the treaty the question of the pollution of the boundary waters and the remedies to be applied are submitted to the commission simply for examination and report. We shall have to report to the Government of Canada and the Government of the United States, and upon our report and recommendation the Governments will take, either jointly or otherwise, the steps which in their judgment are suitable for the occasion.

Now, the different municipalities who received the letter, a copy of which I have just read, are the following: Windsor, Walkerville, Sandwich, Ojibwa, Stony Point, Jeannette, Leamington, Amherstburg, Pike Creek, Puce, Belle River, Colchester, Kingsville, Anderton Township, Maidstone Township, Malden Township, Pellee Island Township, Rochester Township, Sandwich East Township, Sandwich South Township, Sandwich West Township.

I will now ask who represents the city of Windsor for the purpose of this hearing.

Mr. HOWELL. Mr. Chairman and members of the International Joint Commission: On behalf of the city of Windsor, I assure you that it gives me very much pleasure to welcome you to our city on this important visit of your commission. You have no doubt all come from cities very much larger than Windsor, and I notice by the papers that you have been spending the last two days in the beautiful city of Detroit. Windsor can not offer you very much after the good time you have no doubt had over there, but I assure you that such as we have give we unto you. There is one thing that may surprise you; we think we can give you a drink of very pure water, which comes from our water supply, so you need not go thirsty, feeling that you will reap any dangerous result by drinking our water.

In the first place, we are glad to have this commission here, because we think that at this time this matter should be gone into thoroughly, and that the time has now arrived when it is necessary for this step to be taken in order to keep pure the water supply between these two great countries. Another reason why we are very glad to have you here is because it has brought back to our city Mr. Casgrain, who holds a very important place on this commission and who many years ago was a resident of Windsor. It seems that the family of Casgrains has always taken a great interest in public affairs. Mr. Th. Chase Casgrain, as you know, is the chairman of the Canadian section of this commission. We have also with us to-day Dr. H. R. Casgrain, of our city, who is chairman of our Windsor Public Health Board, and it is a great pleasure to us to have this short visit by Mr. Casgrain.

I might say in regard to the letter which Mr. Casgrain has read that we replied to that as follows:

Mr. LAWRENCE J. BURPEE,

Secretary International Joint Commission, Ottawa, Canada.

DEAR SIR: Your favor of August 24 received notifying us that the International Joint Commission would meet at Windsor October 1 and asking if we could supply you with suitable quarters in which the commission could meet. We will have the use of the city hall council chamber reserved for you on that date.

Regarding the matter of our preparing an engineer's report showing you the system which we are going to use to dispose of our sewage, we might say that the time given us is too short for us to present to you a report showing what system we will use. However, we will be glad to meet with your commission and get what pointers we can from you as to the best system to be adopted for Windsor.

As you know, the stringency in which the money market is has made it impossible for us to sell debentures at the present time, and it would be impossible to undertake work which would entail such a large expenditure at the present time. However, we assure you that it is Windsor's intention to co-operate with you in every way in securing a satisfactory system for the disposal of our sewage.

Very truly, yours,

FRED L. HOWELL, Mayor.

Now, I want to say that this matter of sewage disposal is not a new one to Windsor. The council for the past five years has kept track of the work that has been done by the Government, and we have been looking forward to this time to come when it would be necessary for us to provide other systems for disposing of our sewage

than that of dumping it into the Detroit River in its raw state. We have made some investigations in this matter, and it is our intention to send deputations to towns where they have satisfactory disposal plants for sewage and find out the most satisfactory plant for us to use. We have been informed that it depends a good deal on the size of the city as to whether or not it is satisfactory to use one large disposal system or several smaller ones in order to get rid of the volume of sewage. I notice that in Detroit the intersecting sewer has been talked of more than anything else, and that system appeals to us very strongly here. We think we could intercept all of our sewers at the river and by taking them down somewhere below dispose of this sewage and purify it to an extent which would be satisfactory to everybody.

The representatives of the city of Windsor are here to be examined at your discretion. I might say that Mr. Barber has plans prepared showing you the system under which we have supplied water to the citizens of Windsor. I do not think it is necessary for me to speak longer at this time, for in doing so I would only be taking up subjects to be discussed by other representatives, but I would like to thank the members of the different Boards in Windsor who have gone to quite a good deal of trouble to prepare plans and who will present you a satisfactory case as far as they can.

The CHAIRMAN. Gentlemen, this hearing is not limited to the municipal authorities. We shall hear with pleasure anybody who has anything to say to the commission upon the important question which is submitted to us.

I understand that Dr. Park, of Amherstburg, has an important engagement and that he would like to be heard first. Is that right, Dr. Park?

Dr. PARK. Well, I do not wish to break into your program in any way, but I would like to get away by noon if it is possible.

The CHAIRMAN. Probably the gentlemen from Windsor who live here will not have any objection if we hear Dr. Park first.

Mr. HOWELL. I do not think there would be any objection at all, Mr. Casgrain.

STATEMENT OF DR. W. FRED PARK, MAYOR OF AMHERSTBURG, ONTARIO.

Dr. PARK. Mr. Chairman and gentlemen of the International Joint Commission: I might say at the outset that Amherstburg is prepared to do what it can to prevent any further pollution of the Detroit River on its own part. Speaking for the township of Anderton, as well as the town of Amherstburg, of which I am mayor, in respect to the report which you have sent out in re the pollution of the Detroit River, the table of death rates as you have them in your report, I might say it does not indicate in a fair measure the true nature of the conditions in respect to typhoid fever in our locality. I wish to make that point quite emphatic, for where our death rate is small, the number of cases which we have had of typhoid fever have been comparatively great. In about a hundred cases in the last two years I recall only four or five deaths. So you will agree with me when I say that the true nature of the inroads

which are made upon our population by such pollution is not truly indicated by the death rate which your table would indicate. We have also, particularly in the wintertime, a large number of cases of diarrhea, rather typhoidal in character, which are practically never followed by death, but which always mean a large amount of sickness, directly due to the sewage pollution of the Detroit River.

Down in Malden, which is the township lying just below us, we have seen very markedly the result of our own pollution. I might say that there is hardly a house down the whole shore of Lake Erie and the portion of the Detroit River lying below which has not been invaded at some time or other during the last 10 years by several cases of typhoid fever, so that we in those townships and in the town of Amherstburg feel full well that we have a duty to perform by our own citizens, knowing at the same time that it is absolutely impossible that any of our sewage would get across the Detroit River and be a menace to our good neighbors to the west.

This fact may be accounted for in this way: I feel, after 20 years' experience in the practice of medicine in that locality, that the citizens of those townships and the town of Amherstburg have acquired immunity, so far as death is concerned, but it is not strong enough as yet to ward off the attack. I have in course of preparation a map of the town's sewerage system, and I shall be pleased to forward that to the commission as soon as it has been completed. I am sorry that I have not been able to have it with me this morning, but the engineer had not finished it.

The CHAIRMAN. Will you kindly have two duplicates made and send one to the secretary of the commission at Ottawa and the other to the secretary at Washington?

Dr. PARK. I shall be pleased to do so. The town of Amherstburg, as I said, is fully aware of its position in this matter. The ill-effects of sewage pollution have been brought home to practically every citizen. There is hardly a home that has not had in some measure some results from sewage pollution, and I feel that the citizens of the town of Amherstburg are prepared to cooperate with your commission in every way possible to prevent any further pollution along this line. We are already treating the water by chlorination, and that no doubt is a help. As far as the town's finances are concerned, the town, I think, by the time your report is ready, will be prepared to place in force any sewage-disposal system which your commission may come to the conclusion is best for all parties concerned. The town could not, either this year or next year, undertake any very great plans, but after the year 1916 their finances will be in such shape as to enable them to carry to speedy completion any methods which you may suggest.

Mr. POWELL. To what extent do you think purification should be carried?

Dr. PARK. My own idea is this: We throw no garbage into the river in the town of Amherstburg, or practically none. There may be small quantities which slip through our hands, but we practically control the garbage. As far as the sewage is concerned itself, I believe that some plan of filtration with proper chemical sterilization would be the proper method; probably treatment with hypochloride would give immunity to the effluent and possibly incinera-

tion of the more solid portions of the sewage could be carried out. The town is situated in such a way that our sewers could all be diverted into one main trunk sewer. They are all carried below the water-works as it now stands. All the main sewers and all the laterals would be emptied into one main sewer, and I think the ground is suitably adapted for a plan of that kind without any menace to any of the cities.

Mr. POWELL. So that your city is willing to have either fine screening or sedimentation, or both?

Dr. PARK. I think in all probability it could be carried out satisfactorily.

Mr. POWELL. Do you go beyond that and say that you are willing to have the water further purified by chlorination and filtration?

Dr. PARK. I think on behalf of those who live above us that in the light of the experience which the citizens of Malden have had that the town should not throw any sewage into the Detroit River which is likely to cause illness of the citizens of the township of Malden.

Mr. GLENN. Is it treated at all now or is it thrown in raw?

Dr. PARK. It is thrown in raw.

Mr. GLENN. And you only treat it at the intake by chlorination?

Dr. PARK. We treat it by chlorination; yes?

Mr. GLENN. What is the condition of that water before you treat it by chlorination?

Dr. PARK. I think your report shows the condition very well.

Mr. GLENN. Our report is substantially correct?

Dr. PARK. Your report is practically correct. There is no question but what the finding of your corps of chemists and bacteriologists is absolutely correct.

Mr. POWELL. Can you give us any figures as to the chlorination? Can you tell us what quantity of chlorination you use?

Dr. PARK. I do not know. I think some of the sanitary engineers could advise you much better than I along that line. Do you mean as far as our drinking water is concerned?

Mr. POWELL. Yes; how much do you use per million gallons?

Dr. PARK. We place in the drinking water at the present time something in the neighborhood of 8 pounds per million gallons. We have in conjunction with our pumps a small pump that works automatically. As the large pump makes a stroke the small pump automatically throws in just the exact quantity desired. That is thoroughly churned as it is going through the pump and by the time it goes through the standpipe we feel that no citizen in the town of Amherstburg can get a hold of any water that is not practically fit for consumption.

Mr. POWELL. Is the water unpleasant to taste or smell?

Dr. PARK. Since applying the pump we have had no difficulties or no objections on the part of the citizens from either taste or smell, except in the matter of making tea.

The CHAIRMAN. It does not mix?

Dr. PARK. It does not mix.

The CHAIRMAN. Dr. Park, will you kindly give us the population of Amherstburg at the present time?

Dr. PARK. It is about 2,600.

The CHAIRMAN. What is the population of Anderdon?

Dr. PARK. The township of Anderdon has a population of about 1,950. Malden has a population of about 1,900. Amherstburg's summer population will run very close to 4,000.

The CHAIRMAN. What is the assessed value of the town of Amherstburg?

Dr. PARK. It is something in the neighborhood of \$900,000. We have a debenture debt, I think, of about \$120,000 or \$125,000.

The CHAIRMAN. What is the rate of taxation?

Dr. PARK. The rate of taxation has for the last two years been the limit.

The CHAIRMAN. Well, what is the limit?

Dr. PARK. \$20,000,000.

The CHAIRMAN. What revenue do you raise by that?

Dr. PARK. We raise about \$30,000 a year.

The CHAIRMAN. What is the total expenditure for the administration of the affairs of the city?

Dr. PARK. The total expenditure has been practically the same as the income, but, as I said, the town of Amherstburg will be prepared in a couple of years to overcome any difficulties in that way, because we have in the next two years debentures which will have accrued, and payments will have been finished, which will materially lower the taxation rate.

The CHAIRMAN. Have you any idea of what system of purification of sewage would cost the town of Amherstburg, such as outlined by you just now?

Dr. PARK. The main sewer which would connect and divert all the other sewers from the river would probably cost in the neighborhood of \$6,000 or \$7,000. As far as the plant is concerned, I think probably some of our engineers could give you more approximately than I the exact figures which would be suitable for the town of Amherstburg.

The CHAIRMAN. I suppose that last answer would apply also to the operation of the plant?

Dr. PARK. Yes.

The CHAIRMAN. Dr. Park, I believe that there are no towns below Amherstburg on the Detroit River on the Canadian side.

Dr. PARK. There are no towns there. It is simply a continuous farming community down the whole shore of the lake. I have been in touch with the whole lake shore nearly to Kingstown.

The CHAIRMAN. Is the shore thickly populated from Amherstburg down, say, to Bar Point?

Dr. PARK. Yes; rather thickly populated; and there has been a great deal of typhoid amongst those families in that neighborhood.

Mr. GLENN. Where do they get their water?

Dr. PARK. As I explained in February last year, they received their attacks in this way: They had been in the habit of sinking a few tiles in the sand and scooping the sand out and allowing the water from the river to filter through, but they had not gone sufficiently far from the shore to prevent pollution. Back in the township and in the back reaches of the township, where the water supply is from bored wells, there has practically never been any typhoid. The typhoid in the township of Malden has been practically limited to that shore line, and was due to the fact that the farmers in that

neighborhood would use the waters of the Detroit River because they were soft.

The CHAIRMAN. There are no wells in that country?

Dr. PARK. There are wells, but they are all sulphur wells, and the farmers prefer to use the river water.

Mr. MAGRATH. You gave the population of a couple of townships. Is the population dependent entirely upon the Detroit River?

Dr. PARK. No.

Mr. MAGRATH. What portion of the population of the two townships you named is dependent upon the Detroit River?

Dr. PARK. I suppose probably a sixth.

The CHAIRMAN. The township of Malden is above Amherstburg, is it not?

Dr. PARK. No; it is below. Anderdon is above.

The CHAIRMAN. There are Anderdon, then Amherstburg, Malden, and Colchester?

Dr. PARK. Yes, sir.

Mr. POWELL. Does your town publish a financial statement annually?

Dr. PARK. Yes.

Mr. POWELL. Can you send us about 10 copies of that statement?

Dr. PARK. Most assuredly I can.

The CHAIRMAN. I suppose that all the information which I asked you for just now would be contained in that annual statement, would it not?

Dr. PARK. Practically all of it; yes, sir.

The CHAIRMAN. Dr. T. James Park, have you anything to add to what the mayor has said?

Dr. T. JAMES PARK. No, Mr. Chairman. I agree entirely with the mayor and with his statement.

The CHAIRMAN. We will now hear from the mayor of Windsor. We would like to ask you a few questions, Mr. Howell. Do you publish an annual statement of the affairs of the city of Windsor?

Mr. HOWELL. Yes, sir.

The CHAIRMAN. I suppose you have several copies, have you not?

Mr. HOWELL. Do you mean an annual statement of the taxes?

The CHAIRMAN. A statement of the taxes and the population, etc.

Mr. HOWELL. I just asked our treasurer to prepare something to submit to you showing the amount we collect each year.

The CHAIRMAN. I suppose if we asked you for any other information you could give it to us?

Mr. HOWELL. Yes, sir.

The CHAIRMAN. I suppose, also, that if we find there are some omissions in this public statement you would have no objection to giving us any other information which we might require?

Mr. HOWELL. No, sir.

The CHAIRMAN. What is the population now of the city of Windsor?

Mr. HOWELL. It is about 25,000. Last year it was about 23,000.

The CHAIRMAN. How do you dispose of your sewage?

Mr. HOWELL. At the present time we dump it into the Detroit River raw.

The CHAIRMAN. How do you dispose of your garbage?

Mr. HOWELL. We have an up-to-date system and we dispose of all our garbage in an incinerator.

The CHAIRMAN. None of the garbage is thrown into the river?

Mr. HOWELL. None of it goes into the river or sewers.

The CHAIRMAN. How many outlets have you to the sewers here? Have you a plan of the sewerage system?

Mr. HOWELL. We have a plan. I was going to suggest that you might hear from the civil engineer as to the way we get our water, and then the city engineer could give you all the particulars about the number of outlets, as he has a map prepared here already.

Mr. MAGRATH. Where do you get this water from?

Mr. HOWELL. Our civil engineer will show you the system we have of procuring the water, which has given us so far pure water.

Mr. TAWNEY. I suggest that we call Mr. Barber, then.

STATEMENT OF MR. C. M. BARBER, CIVIL ENGINEER, OF WINDSOR, ONTARIO.

Mr. BARBER. Gentlemen, as an employee of Smith, Hinchman & Grylls, of Detroit, I was employed to put in an intake pipe for the waterworks. I have here a drawing showing the profile of the river at the intake and the general scheme of the intake pipe. The waterworks, of course, were already constructed, and our part of the work was simply the putting in of the intake. The intake is 550 feet from the shore line or a sheet piling driven by the railroad company.

Mr. POWELL. How far above the town line?

Mr. BARBER. It is between Walkerville and the upper part of Windsor. The pipe is 60 inches in diameter, and the outshore end of it is about 7 feet above the bottom and in about 42 feet of water at a normal stage of the water. The water enters what we call a screened well, where the current is decreased considerably, and the water passes through copper screens and thence is pumped into the system. These screens are changed quite frequently so as to clean them. They intercept nearly all of the floating matter; that is, anything that will not pass through a No. 8 copper screen.

The CHAIRMAN. Is the water treated?

Mr. BARBER. The water, I believe, is treated. We had very little to do with that. We made the report upon that subject upon which they operated later, but we did nothing more than to make this report.

Preliminary to this work we went up the river to Walkerville, at the entrance of the main sewer in that town, and placed a line of floats extending out into the river, which are distinctly shown on this drawing, and those were followed as they went down the river by a boat, and also another boat at the intake pipe. These floats showed the current of the water 4 feet below the surface. They were floats that were placed at that distance below the surface as indicated on the top. They were all marked and numbered, and their location numbered as they were put into the river and noted as they were taken out. Some of them, as you will see by that map, went ashore in the shallow water. The water being less than 4 feet deep, they grounded, and in some places we carried them out a little ways and started them again.

Mr. TAWNEY. What was the object of putting these floats in the river?

Mr. BARBER. To determine the current from the sewers and to determine where the general flow of the main current was.

Mr. TAWNEY. You were trying to establish your intake so as to dodge the sewage?

Mr. BARBER. Yes, sir. We found that the sewage seems to run right close to the shore and the configuration of the bottom is such that it is very shallow for some distance out, as the profile shows, and the warm water of the sewer seemed to remain in the upper portion of the current and to run close to the shore. In fact, all the floats that we put in anywhere near the sewer went close to the shore. Only a few of them came down as far as the waterworks, and those that did were close inshore, as shown on the diagram.

Mr. POWELL. Were these tests made on simply one day or on a succession of days?

Mr. BARBER. They were made on several different days. We have made quite a number that are not shown on the map. There was often some little hitch or something that caused them to work not just right, and we tried it over again.

Mr. POWELL. With practically the same result?

Mr. BARBER. Yes, sir.

The CHAIRMAN. What is the population of Walkerville?

Mr. BARBER. About 5,000.

The CHAIRMAN. Is there any town or conglomeration of inhabitants above Walkerville on the river or the lake shore?

Mr. BARBER. Yes; there is a place called Ford.

The CHAIRMAN. What is the population of Ford?

Mr. BARBER. I think they have about 800.

The CHAIRMAN. Do their sewers empty into the river, also?

Mr. BARBER. Yes. I think they had some trouble in getting permission from the board of health to put any sewerage in at all. I do not think they have any sewers. They have a few drainpipes in.

The CHAIRMAN. I suppose, then, that after making these experiments you located your intake so you would not get any of the sewage coming from Walkerville?

Mr. BARBER. We get no sewage from Walkerville. Other tests were made of the water from near the location of the intake, and reports were made on it by the Canadian authorities. I understand that these tests were prepared and sent to the chemist without his knowledge as to where they came from, and in every case the water was reported to be good, potable water from near the intake.

Mr. MAGRATH. There is no possibility of winds affecting those floats or the sewage coming down so that it would not come in the line that you show there?

Mr. BARBER. Winds at various times of the year probably might affect it to some extent. I should think they would. But, generally speaking, the flow down the river is pretty constant, and the distance from these sewers is comparatively short. One idea that we had there was that the sewer waters were almost uniformly warmer than the water in the river. The water that we get from the intake pipe is from the main channel of the river, and we estimate it to be considerably colder than the water inshore—giving another reason why the water at that point would be clearer than near the shore.

Mr. GLENN. You consider the water, then, at Windsor, at the intake, practically pure?

Mr. BARBER. Yes, sir; we think it is practically pure. Of course, there are disturbances in Lake St. Clair and times when the water is turbid. All the water in the Detroit River, I suppose, is turbid, but that would concern the water from Lake St. Clair probably more than the sewage.

Mr. GLENN. That would only be the case in time of storms?

Mr. BARBER. Yes; in the case of storms and the breaking up of the ice in the early part of the season.

Mr. POWELL. Your purification begins with chlorination?

Mr. BARBER. The water is chlorinated. They use the hypochloride system there. We made a report on that in the first place, upon which the board of commissioners acted at a later period.

The CHAIRMAN. Who is able to speak as to the treatment that the water receives?

Mr. BARBER. The local engineer, Mr. Hanrahan.

Mr. POWELL. Let me get your functions. You are not employed by the city?

Mr. BARBER. Not regularly; no, sir; just in this special case for the installation of this intake pipe.

Mr. POWELL. Have you many of those blue prints?

Mr. BARBER. We have the tracing. We can have others struck off.

Mr. POWELL. We would like to have two of each if you can furnish them. Please send one to each secretary of the commission.

Mr. BARBER. I shall have that done.

The CHAIRMAN. We would like to hear from the city engineer now.

STATEMENT OF MR. M. E. BRIAN, CITY ENGINEER OF WINDSOR, ONTARIO.

Mr. TAWNEY. You have a plan of the sewerage system of Windsor, have you not?

Mr. BRIAN. Yes, sir; I prepared this for the Ontario Board of Health a couple of years ago, and it is up to date. I can make you any number of copies of it that you may wish.

Mr. TAWNEY. Will you make us two copies of each and send them to the commission?

Mr. BRIAN. Yes, sir.

Mr. TAWNEY. The sewage of the city of Windsor is dumped raw into the Detroit River, is it not?

Mr. BRIAN. Yes; without any treatment whatever.

Mr. TAWNEY. Can you tell us what the quantity of sewage is each day that is dumped into the river on an average?

Mr. BRIAN. We have never made any test of the thing, but it would be probably 15 cubic feet per second.

Mr. POWELL. Convert those second-feet into gallons per day.

Mr. BRIAN. It would be in the neighborhood of between seven and eight million gallons. That is practically the pumpage of the city.

Mr. POWELL. That is about the proportion of Detroit.

Mr. BRIAN. Yes. Our soil here is a very heavy clay. There are 13 outlets, and they are all shown on the map.

Mr. GLENN. Have you made any estimate of what it would cost you to screen or treat it in any way?

Mr. BRIAN. No, sir. I might say that we are at present making a contour map of the city for just such a purpose as this. We are looking forward to the treatment. The Ontario Board of Health asked for a contour map, and we are making it on their request.

Mr. POWELL. You had better send us a couple of copies of that, too.

Mr. BRIAN. You could not get the copies for six months, as we have to do that work in the wintertime.

Mr. MAGRATH. Are you contemplating changing your system at the instance of the Ontario Board of Health?

Mr. BRIAN. Not necessarily that way, but the Ontario Board of Health, in connection with this International Waterways Commission, got quite a bit of information from us, and this map was prepared for them; and they also wrote for a contour map of the city, which we are making for them and which they can use for this purpose as well. We shall have to have one if any change is made in the present system.

The CHAIRMAN. Have you ever considered any plan for disposing of the sewage of Windsor other than by dumping it into the Detroit River?

Mr. BRIAN. I have not gone into it in a technical way at all.

Mr. GLENN. What would an intercepting sewer cost?

Mr. BRIAN. I have not the faintest idea, but I imagine it would be tremendous, especially where we would have to put it. It would have to be put down in the river. If you will look at the elevations of the outlet you will see what it is, and then we have two heavy railroad companies besides. It would have to be put down toward the river, where we can catch the lowest possible outlet for it.

The CHAIRMAN. There is a natural slope of the land toward the river here, is there not, Mr. Brian?

Mr. BRIAN. Yes.

The CHAIRMAN. How much of a slope?

Mr. BRIAN. There are 35 feet, I believe, from Tecumseh Road to the river. That is a distance of a mile and three-quarters.

The CHAIRMAN. Speaking generally, the population of Windsor has increased, has it not?

Mr. BRIAN. Yes; wonderfully.

The CHAIRMAN. It is increasing all the time?

Mr. BRIAN. Yes, sir.

The CHAIRMAN. What is that due to—the advent of factories here, or is it a natural growth?

Mr. BRIAN. To a certain extent; and then it is a good place, I believe, too.

Mr. GLENN. In addition to supplying water to Windsor you supply water to other towns below you, do you not?

Mr. BRIAN. I am not connected with the waterworks, but I know as a fact that they have supplied Sandwich and Sandwich West. Possibly the secretary of the board could give you information on that subject.

Mr. GLENN. We would like very much for you gentlemen to get together and figure a little on what the cost to treat your sewage would be, so as to help us when we come to the point of reaching a conclusion as to what we ought to require of you. You know your financial con-

ditions and surroundings a great deal better than we do, and if we cooperate in that way we might come to some conclusion that would be a great deal more advantageous to you than if we were to work it out for ourselves.

Mr. BRIAN. I think there are about 2,400 acres in Windsor. We are small as compared to Detroit, and you gentlemen know, and possibly the engineers will tell you, that it is going to take a tremendous amount of work to figure this system out here. You can not do it in a week or a year.

Mr. GLENN. We may not be able to figure it out in a year, but we want you to figure it out, and we can give a little and you can give a little, and we can come to some advantageous proposition to all the towns around here.

Mr. BRIAN. But the average engineer is not a sanitary expert, and I believe that the sanitary experts would have to look after that.

There is another point with regard to the dry-weather flow. An intercepting sewer has been suggested along the river front. You would have to treat your storm water. Before going into that I had better say that our system is a combined one. If we put that intercepting sewer in we shall have to treat storm water, which is not polluted.

Mr. POWELL. Not to the same extent.

Mr. BRIAN. No. Then, it is a question with a sanitary expert whether it would be a cheaper proposition to use the ordinary sewers that we have at present for the storm water and put in a separate system, with an intercepting sewer at some other place, with a treating station, where we would not have such a great upkeep and such a great financial cost to treat it. We have a tremendous lot of outlets for a small place. Some of them are 5 feet in diameter and some 4 feet in diameter.

Mr. GLENN. What is the distance all the way down?

Mr. BRIAN. It is a little over 2 miles. Of course, all our outlets are below the waterworks intake.

Mr. POWELL. From the contour of the country along the river bank here would it be necessary to have pumping stations?

Mr. BRIAN. It is either pump in or pump out. You would either have to pump your raw sewage into a settling tank or let it run into a settling tank and then pump out.

Mr. POWELL. Are the levels of the water front adapted to having a surface bed?

Mr. BRIAN. No; I would not say that. Windsor is the highest place practically and it slopes both ways. Our east end is much lower than our west end. We slope toward Walkersville and toward Sandwich. Sandwich is not as high above the river as we are.

STATEMENT OF MR. WILLIAM A. HANRAHAN.

The CHAIRMAN. Mr. Hanrahan, you are in charge of the waterworks at Windsor, are you not?

Mr. HANRAHAN. I do not know that I am in charge. I am the secretary of the department. There is a superintendent.

The CHAIRMAN. Who is the superintendent?

Mr. HANRAHAN. Joseph Hall.

The CHAIRMAN. Is he here?

Mr. HANRAHAN. No, sir; he is not present.

The CHAIRMAN. How is the water treated here that you distribute to the population?

Mr. HANRAHAN. It is chlorinated.

The CHAIRMAN. What is the quantity of chlorine that you use?

Mr. HANRAHAN. About 12 pounds to the million gallons.

The CHAIRMAN. What is the result as to taste and smell of this water which is treated in this way?

Mr. HANRAHAN. I have only once in two years noticed a slight taste.

The CHAIRMAN. Do the people complain of the taste or the smell?

Mr. HANRAHAN. Not as a rule.

The CHAIRMAN. Not as a rule, but some do?

Mr. HANRAHAN. Once in a while some one imagines that he can taste it. In consulting with Dr. McCullough before the installation of the treatment he suggested to the commissioners to put in the chlorination treatment and use it for six months before the people knew anything about it. He said, "If they know it is coming along, they will write you and telephone you about it." That was done, and it was six months before anyone knew anything about it and there was no complaint whatever, but the day after the newspapers published the fact that the water had been treated we had a number of complaints; they had all tasted it.

Mr. POWELL. Did you ever consider the propriety of filtering the water?

Mr. HANRAHAN. We undertook it many years ago, but we found it used so much water that the plant was not large enough. At regular intervals we have taken water from the river and sent it to Toronto to the provincial board of health to test and the reports show that the water was good.

The CHAIRMAN. Do you mean the water as treated or before it was treated?

Mr. HANRAHAN. Before treating.

Mr. POWELL. Have you any regular bacteriological examinations made of the water?

Mr. HANRAHAN. In Toronto they were made.

Mr. POWELL. But you have none here; no daily records?

Mr. HANRAHAN. No, sir.

Mr. POWELL. A bacteriological examination made daily may show an almost absolutely pure water and then in a few days it may be different.

Mr. HANRAHAN. We take the samples and send them away packed in ice and they will be in Toronto the next morning, about twelve hours after they are taken.

Mr. GLENN. How long have you been treating this water by chloride?

Mr. HANRAHAN. Two years last February.

Mr. GLENN. What was the condition of your water before you commenced treating it?

Mr. HANRAHAN. We began treating it as a precautionary measure.

Mr. GLENN. You would not have commenced treating it if you had not thought it necessary to do so?

Mr. HANRAHAN. There was typhoid up in Sarnia and the commission thought it was a good precaution. They thought we should not wait until damage was done.

Mr. GLENN. Have you had any typhoid here?

Mr. HANRAHAN. Yes; I believe there is typhoid here.

Mr. POWELL. The board of health has a representative here, has it not?

Mr. HANRAHAN. Yes, sir; Dr. Cruickshank, and he can give you information on that subject better than I can.

STATEMENT OF DR. H. R. CASGRAIN.

The CHAIRMAN. Dr. Casgrain, what is your official position here in the city?

Dr. CASGRAIN. Chairman of the board of health.

The CHAIRMAN. How long have you held that position?

Dr. CASGRAIN. Just this year.

Mr. GLENN. Doctor, do you know anything about the conditions here in this city with regard to the water?

Dr. CASGRAIN. Yes, sir. It has been a question that has excited a great deal of comment for the last 25 years. We have endeavored at several times to improve the conditions of affairs without being able to do so, but in view of the reports we have received from different sources the rate of sickness due to bad water has been very small indeed. For instance, we have never had a regular epidemic of typhoid fever due to bad water except on one occasion, and that was purely accidental. There were two intakes, one from near the shore and another about a hundred feet out. The outer intake became clogged and they opened the inner intake, and it was then that we got our epidemic. That was in 1869. We have not had any regular epidemic of typhoid fever in the town since. We have the usual number of cases that they call endemic typhoid at this season of the year, the cause of which we do not know, but since the water has been chlorinated there has been less typhoid fever than before.

I must disagree with our friend, Mr. Hanrahan, because he doesn't drink anything but cold water. The taste of chlorine is very perceptible in the water. As he said, they were chlorinating the water for six months before they knew anything about it here, and there were no complaints, but since the public got on to the fact that they were chlorinating it they began to smell the chlorine.

Mr. GLENN. What is the effect upon the health of the people in regard to that chlorination?

Dr. CASGRAIN. It has absolutely no bad effect.

Mr. GLENN. It is just regarded as being unpleasant.

Dr. CASGRAIN. That is all.

Mr. GLENN. It does not injure the stomach?

Dr. CASGRAIN. No, sir.

Mr. POWELL. If used to excess it does, though.

Dr. CASGRAIN. Yes; they used to use 18 pounds to the million gallons here, and now they have got down to 12 pounds. We have 15,000 people, and we haven't got 15 cases of typhoid in the town.

Mr. POWELL. Would you say relative to these other communities that your typhoid rates are low?

Dr. CASGRAIN. Yes; our rates are low.

Mr. GLENN. You do not know anything about the conditions of the sewage, do you?

Dr. CASGRAIN. No; I know the Walkerville sewage empties just above our intake pipe.

Mr. GLENN. As a health officer, what do you think about emptying the raw sewage into the river?

Dr. CASGRAIN. I think it is a rotten procedure to do it.

Mr. MAGRATH. Is there any sentiment in Windsor along the line of changing the present system of dumping raw sewage into the river?

Dr. CASGRAIN. No; the people have not been sufficiently educated upon that point yet. What they are afraid of is the expense. The city has in the last few years gone to a great expense in building sewers, and if that system has to be changed now, with the present high rate of taxation, they are afraid they will be ruined. I think, however, that by a little process of education they will arrive at the point where they can enter into some arrangement with Ford, Walkerville, Windsor, and Sandwich and let the sewage be emptied below or be treated at the other end.

Mr. POWELL. Do you mean to have a common pipe?

Dr. CASGRAIN. Yes.

Mr. GLENN. Do you furnish water to other towns below you?

Dr. CASGRAIN. To Sandwich and a part of Sandwich West.

Mr. POWELL. How is the ground here? Is it of a rocky nature?

Dr. CASGRAIN. No; it is more sand.

Mr. POWELL. So it would not cost a great deal to install a common sewer?

Dr. CASGRAIN. No.

Mr. GLENN. How far is it from here to Amherstburg?

Dr. CASGRAIN. About 18 miles.

Mr. GLENN. Do you think this sewage here affects Amherstburg?

Dr. CASGRAIN. I can not see how it could help it. To a certain extent sewage purifies itself as it floats down the river, but I do not see how they can escape pollution in Amherstburg.

Mr. POWELL. I asked the question because it was suggested to me this morning that the next town below you was so far off that your town could not hurt it any.

You mention an interesting fact there, Dr. Casgrain, about the two intakes. One would be more in the line of the sewage that hugged the shore?

Dr. CASGRAIN. No; they do not use that inner intake now. When I was water commissioner I had the intake placed 500 feet out in the river. The water taken at 500 feet out in the river was free from colon bacilli.

Mr. POWELL. And the immediate sequence, whether it was the consequence or not, of the clogging of the outer intake and the opening of the inner was an outburst of typhoid fever?

Dr. CASGRAIN. Yes, sir.

Mr. POWELL. At that time was there any typhoid fever in Walkerville?

Dr. CASGRAIN. I could not tell that very well. I do not think so, however. That was produced by the Walkers. They have a large

farm at Walkerville, and they dump the liquid manure on the fields. They make a sort of pond and they fill that pond full. For some reason or other, one of the banks gave way and the sewage ran into the river, and we got it here.

Mr. POWELL. You take a more common-sense view of it than some of these analysts. You would say that is only beef tea in another form?

Dr. CASGRAIN. I would not say that was beef tea. I often recommend beef tea to some of my patients, and they would not want to take it.

STATEMENT OF MR. HENRY HOWE, MAYOR OF WALKERVILLE, ONTARIO.

Mr. CASGRAIN. What is the population of Walkerville?

Mr. Howe. Five thousand.

Mr. CASGRAIN. What system of sewage have you?

Mr. Howe. Our sewage runs into the river through open sewers.

Mr. CASGRAIN. How many outlets?

Mr. Howe. Five.

Mr. CASGRAIN. What is the total value of the property of the corporation of Walkerville?

Mr. Howe. The assessed value this year is \$7,050,000.

Mr. CASGRAIN. Do you publish an annual financial statement?

Mr. Howe. Yes; that is compulsory for every municipality.

Mr. CASGRAIN. Will you send the commission a number of copies of your last financial statement?

Mr. Howe. I shall be pleased to do so.

Mr. CASGRAIN. Have you had any epidemics of typhoid in Walkerville?

Mr. Howe. We have very little typhoid of any kind.

Mr. CASGRAIN. Is there any complaint about the sewage polluting the water from which you take your drinking water?

Mr. Howe. There have been complaints from Windsor, but no complaints from us.

Mr. CASGRAIN. They complain that you dump your sewage into the river, and that it spoils the water for them.

Mr. Howe. There have been complaints of that kind in the past.

Mr. CASGRAIN. Are there any densely populated towns above you on the Canadian side?

Mr. Howe. Only Ford, which has a population of about 1,800.

Mr. CASGRAIN. Do you know how they dispose of their sewerage in Ford?

Mr. Howe. They have tiled drains, but mostly open. Ford is a municipality that has sprung up within the last two years, and it is called Ford from the automobile factory erected there. They have quite a large Ford factory there.

Mr. CASGRAIN. Has there ever been a plan mooted in Walkerville for the disposal of the sewerage otherwise than by dumping it into the river?

Mr. Howe. We have not got that far. In fact, we came down here to-day to get what information we could at this time, to see if there was any suggestion we could adopt.

Mr. CASGRAIN. Do you take your water from the river?

Mr. HOWE. We have a private corporation that takes the water from the river. It is not a municipally owned plant. I thought the manager would be down here to-day, but the information he would give would be similar to what you have been getting; it is the same system. The other towns treat the water, probably not quite so much, but it is the same treatment, anyway.

Mr. CASGRAIN. They chloride the water?

Mr. HOWE. Yes.

Mr. CASGRAIN. Do you know anything about the drains which come down from the cattle sheds belonging to the Walker distillery? Do the Walkers still have cattle there?

Mr. HOWE. Yes.

Mr. CASGRAIN. How many head at a time?

Mr. HOWE. Probably 2,000.

Mr. CASGRAIN. And they keep these cattle there how long?

Mr. HOWE. During the winter months; they fatten them in the winter and ship them in the spring.

Mr. CASGRAIN. Where do the drains run into from these stables?

Mr. HOWE. That is outside the town, just on the town limits. There is no sewer. At one time they had a small sewer there that ran into one of our sewers, but I believe that has been changed since. I do not believe they use the sewer now.

Mr. CASGRAIN. Do you know whether or not the refuse from these stables runs into the river?

Mr. HOWE. It must do so in certain ways, because the lay of the land is such that it would run into the river anyway.

Mr. CASGRAIN. How far back from the river is it?

Mr. HOWE. About 2 miles.

Mr. GLENN. It is above your intake?

Mr. HOWE. No; it is below the intake. Walkerville is situated very narrow, and extends back nearly 2 miles from the river. It is only about a quarter of a mile wide. Our intake is above Walkerville altogether, opposite Ford.

Mr. GLENN. What is the total revenue from all sources of the town of Walkerville?

Mr. HOWE. It is somewhere about \$79,000.

Mr. GLENN. What is the expenditure?

Mr. HOWE. The expenditure is about the same as the revenue. The revenue is supposed to meet the expenditure.

Mr. GARDNER. Is the town growing rapidly?

Mr. HOWE. It has been for the last five years.

Mr. GARDNER. What are the chief industries?

Mr. HOWE. There are two or three paint shops, Peabody's overalls, and Walker's distillery, of course, which employs a lot of men; there are several other industries.

Mr. CASGRAIN. Is there any objection to the town of Walkerville treating its sewage?

Mr. HOWE. No.

Mr. CASGRAIN. You are willing?

Mr. HOWE. We are willing to do what we have to do.

STATEMENT OF OWEN M'KAY, CIVIL ENGINEER.

Mr. CASGRAIN. What is your official position, Mr. McKay?

Mr. MCKAY. I was formerly a railway engineer; at present I am doing a local practice; I am engineer for the town of Walkerville, and I do whatever engineering they require in Ford.

Mr. CASGRAIN. Are you a sanitary engineer?

Mr. MCKAY. I lay out sewers, but I do not claim I am a sanitary engineer.

Mr. CASGRAIN. How about the sewage system of Walkerville; how are the sewers laid?

Mr. MCKAY. We have a west main sewer and an east main sewer. The west main sewer is 42 inches in diameter, and the east main sewer is 24 inches in diameter, and then lately we have a relief main sewer as these two sewers were not sufficient to prevent flooding during heavy rainstorms. These sewers extend from a southerly direction and have their outlet into the river.

Mr. CASGRAIN. The sewage is dumped raw into the river?

Mr. MCKAY. Yes.

Mr. CASGRAIN. Can you state what quantity of sewage is dumped into the river?

Mr. MCKAY. We have a population of about 5,000, and I would imagine the sewage from all these people would discharge into the river. It would be the ordinary average.

Mr. GLENN. How about the town of Ford?

Mr. MCKAY. They have no sewers whatever. Some years ago the medical health officer complained that there was stagnant water lying in front of the houses and that it would be necessary to carry it off, and for this reason they made a small shallow sewer, 5 or 6 feet in depth, of drain pipes entering into the river and connected these drain pipes with the houses. The sewer system of Ford City is very imperfect. This last summer I made out a plan of sewers for Ford City and submitted it to the provincial board of health, but they refused to adopt it, and in that way the sewage of Ford City is in a very bad way from a sanitary point of view.

Mr. GLENN. Does the Walkerville farm discharge its sewage into Ford City?

Mr. MCKAY. No; below Ford City.

Mr. GLENN. Do you know anything about the sewers there?

Mr. MCKAY. The residences there have private drains into the river.

Mr. GLENN. How does the Walkerville farm get rid of its sewage?

Mr. MCKAY. They discharge through a drain pipe into our system of sewerage.

Mr. GLENN. Do they have any stock there in the summer?

Mr. MCKAY. They have none in the summer. They have a large number of cattle in the winter.

Mr. GLENN. Do you treat the water in any way?

Mr. MCKAY. We treat the water.

Mr. GLENN. But you do not treat the sewage?

Mr. MCKAY. No.

Dr. G. R. CRUIKSHANK (medical health officer, Windsor). Gentlemen, without attempting to reiterate the expressions of pleasure spoken by the mayor in seeing you among us, I may say that for

20 years we have looked forward to something of this kind. I have only been health officer for three or four months, and I may not have the minutiae of detail I should like to have, but I have practiced in the city for 25 years, and I feel somewhat well acquainted with the situation.

The first point I would like to speak about is the wisdom of some means of purifying the sewage. That is, without question, acknowledged by everyone. The second point I want to make is that there is no immediate hurry; and speaking of this, there are several paradoxical things to which attention might be directed. The first is that for 25 years we have been having our water examined in the provincial laboratory in Toronto, and we have found that the examinations, on the whole, were much better at our intake below the Walkerville sewer than above. That is a paradox; the examinations made in the laboratory in Toronto have shown the water better below the Walkerville sewer than above it.

Mr. CASGRAIN. Can you account for that?

Dr. CRUIKSHANK. I can account for it in two ways. In the first place, I do not think the examination was much use, because I think the bacteria died on the way to Toronto, and, in the next place, that our intake should always be above a sewer. There is nothing could induce me to believe that a water intake should be permitted below any sewer. However, that is a paradox. It may be, as the former health officer maintained, that sedimentation was sufficient to purify the water. But the paradox is continued. There is less typhoid the farther down the river you go. I do not think there has been a death from typhoid in Amherstburg this year. It would seem the farther down you go to get the water and the more sewage you put into it the better the water. Notwithstanding this, I think something must be done to purify the sewage.

Mr. MAGRATH. You do not know if the Walkerville distillery has anything to do with the absence of typhoid?

Dr. CRUIKSHANK. Well, a number of gentlemen seem to be free from typhoid in this vicinity. I am now back to the point that in my opinion there is no hurry about this thing. We are not suffering from disease. There are only two diseases we can get from sewage, typhoid and cholera. We may get disease conditions, such as diarrhea from the water. I am not questioning whether we can or not, but there are only two diseases carried by water, typhoid and cholera. We can not get cholera from anything but cholera germs, nor typhoid from anything but typhoid germs. We are not overwhelmed with typhoid. In Windsor to-day there are 14 cases in two months, and the deaths have been comparatively few, and as a matter of fact that paradox continues.

We have in the past been in the habit of attributing the typhoid to the water, because we know that typhoid can be carried by water, but lately we have come to the conclusion that many cases of typhoid were due to typhoid carriers. Some person has typhoid, and the typhoid germs remain active in the system, and he handles foodstuffs such as fruit or milk, and people who consume them get the typhoid, and it is quite possible that typhoid may be due to flies carrying the germs. I think I have said enough to show that there is no hurry whatever on this point. Although it is advisable and wise to treat the sewage, and although we desire it, we do not see any occasion for precipitate haste.

Mr. GLENN. Why is it you do not want to hurry; is it because of financial reasons?

Dr. CRUIKSHANK. That is the chief point. We know a great many ways of thoroughly purifying sewage, and if I wanted to say something absurd I could say we could purify it thoroughly by boiling it, but that is out of the question. Some other propositions may be equally absurd. Some means of purifying sewage that would be beyond our means would be practically as absurd as a thorough purification by boiling it. Some years ago the board of trade made a recommendation that some expert should be employed to look over the situation, study all the scientific data, and make some suggestion for us. That seemed to me the wisest thing suggested yet, because every man in town thinks he knows what should be done, and a great many of them know very little. The doctors, who are supposed to know more than the others, differ very much among themselves, and some of our wisest and ablest men have ideas I do not approve of with reference to sewage and water.

I do not believe I would want to drink water that passes through a filter if it comes out of a closet, and I don't care how good the filter is. We can not expect the public, who have to vote on this matter, to agree among themselves when doctors can not agree, and the best thing we can do is to get some outside person, thoroughly experienced, to decide for us. That is the very thing that we have at our disposal to-day in this commission. You have experts, and instead of asking us for a plan we ask you to give us the advice of your experts, to consider our financial condition, to consider the scientific aspects of the case as to the disposal of sewage, and to make suggestions as to what would be advisable. That is the very thing we have been looking forward to, and it is the very thing that the board of trade suggested years ago. That suggestion was that some outside expert, of unquestionable ability, should make to us a suggestion as to the best means of doing this. We are hard up just now, and we will perhaps be hard up again next year; the medical health officer does not get any salary to amount to anything. My idea would be to get from the experts which this commission has at its disposal their expert opinion as to what should be done, and we will be in a position to do it later on and to carry out any reasonable suggestion. We can do it from the æsthetic point of view, if it is not absolutely necessary from the health point of view. I am sorry I have not heard all that has been said here this morning, as I had to be absent for some time, and one who is not accustomed to speaking always forgets some good point until after he sits down.

Mr. GLENN. Our object is to get a knowledge of what you have already done, what you want to do, what you are able to do, and what you are willing to do, so that we can see what we ought to do.

Dr. CRUIKSHANK. We are willing to do anything we can afford to do, and we naturally would be willing to accept your suggestion as to doing anything reasonable. We would like to get some outside scientific opinion of undoubted authority to make suggestions, and then we would likely combine and carry the scheme out, if it is in our power.

Mr. GLENN. You want us to put it off for two years; do you think you will be any better off then?

Dr. CRUIKSHANK. I think when the war is over we will be better off.

Mr. GLENN. Can you say when the war will be ended?

Dr. CRUIKSHANK. If it doesn't end pretty soon, we will send over a few more Canadians. There is no question that this will be a large city some day, and some day pretty soon. We believe Windsor will be an immense city in time to come, and while we may not enter into purification of our sewage at once we should have a plan before us. The experts at the disposal of this commission are the best authorities I know to give us that plan. If we get from your experts a reasonable suggestion that is within our means to carry it out, you can depend on the city of Windsor to carry it out.

Mr. GLENN. As one of the commissioners, I may say that we have been very much pleased by the reception we have received this morning from your people; you have been very kind to us.

STATEMENT OF CAPT. WILLIAM PARKER, SUPERINTENDENT OF THE FISH HATCHERY AT SANDWICH.

Mr. CASGRAIN. You are the superintendent of the Dominion Fish Hatchery at Sandwich?

Capt. PARKER. Yes.

Mr. CASGRAIN. How long have you occupied that position?

Capt. PARKER. Thirty-two years.

Mr. CASGRAIN. Do you know anything about the fish in the Detroit River before you came here?

Capt. PARKER. No.

Mr. CASGRAIN. I remember that the fisheries on the Detroit River used to be very profitable.

Capt. PARKER. They are to-day, but there are different kinds of fish. When I came here 32 years ago the herring were in abundance in this river; you could catch them in millions, but to-day you don't find any herring in the river.

Mr. CASGRAIN. What fish do you find?

Capt. PARKER. Whitefish. We have perch, bass, bullheads, and things of that kind.

Mr. CASGRAIN. What effect, if any, has the pollution from different sources had upon the fish in the river?

Capt. PARKER. So far as the hatchery is concerned, we do not find that the sewage has done us any harm. There is a run of the coarser fish, such as perch, bass, and pickerel. We have a great deal larger run of fish on our side of the river than they have on the American side, and I think, perhaps, the sewage has something to do with it, because, of course, they have a larger amount of sewage on the American side than they have on the Canadian side.

Mr. CASGRAIN. If the fish has decreased in numbers in the river, do you attribute that to the pollution?

Capt. PARKER. I do, partially; the traffic on the river has something to do with it.

(Mr. Casgrain asked if anyone else wished to address the commission.)

JEREMIE DUCHARME (reeve of Belle Riviere). We have no sewerage at all in our village; it is a small village of 700 population.

Belle Riviere is situated on the banks of Lake St. Clair about 17 or 18 miles east of Walkerville.

Mr. CASGRAIN. You do not empty your sewage into the lake?

Mr. DUCHARME. No; we have two streams running through Belle Riviere, which are small rivers, and that is about the only drainage we have. We drain into these creeks, and they empty out into the lake.

Mr. CASGRAIN. Belle Riviere is a farming community?

Mr. DUCHARME. It is, and the people are talking about putting some kind of sewerage in there, and I would like your opinion as to the best means of doing it.

Mr. GLENN. You are all putting it up to us.

Mr. CASGRAIN. Have you a health department in Belle Riviere?

Mr. DUCHARME. Yes; we have a board of health organized in the town; I am the chairman of the board of health.

Mr. CASGRAIN. Have you a waterworks?

Mr. DUCHARME. No; we are getting our water from wells. Mostly everybody has wells.

Mr. CASGRAIN. What is the condition of your health?

Mr. DUCHARME. Pretty good; I do not believe we had one case of typhoid for the last four years, and that was my own child, who was attending school in Windsor, that caught it. We burned everything, and there was no spread of the disease at all. Since that we never heard of a case of typhoid in the village, so that the water must be pretty good. The main thing is to get the overflow of the water, if we put the waterworks in, and I don't believe that then it would pollute the lake.

Mr. CASGRAIN. How wide is the lake at Belle Riviere?

Mr. DUCHARME. Eighteen or twenty miles wide.

Mr. GLENN. These creeks into which your sewage goes run into the lake?

Mr. DUCHARME. Yes.

Mr. GLENN. How far are you from the lake?

Mr. DUCHARME. We are just on the verge of the lake.

Mr. GLENN. There is a fall in that locality?

Mr. DUCHARME. The water is very slow. It comes to a standstill in the summer months; it keeps with the level of the lake. With a north wind the water will back into the creeks and when the wind shifts it goes out.

J. S. SMYTH (water commissioner, Windsor). I can not say anything that would enlighten you very much on this great question. I have been connected with the water service of the city since 1902; we have sent a great many samples down to the provincial board of health in Toronto, and I can say that all the samples that were taken from the intake in the center of the river have always been found good. I remember one day going up to Peach Island with Mr. Walker, and we took samples there thinking we would get better samples, and when the report came back the report was no better than we were in the habit of having. We did send samples from the inner intake which we do not use, and every time we sent these samples the report was unfavorable, the water was contaminated. That proved to us that our water was very good. I think since we have adopted the chlorination system we are pretty free and have very good water.

Dr. W. J. BEASLEY (medical health officer, Sandwich). If Dr. Cruickshank's contention is correct, then I think Sandwich will put in its own water system. We are getting our water now from Windsor, and if his contention that the farther down and the more sewage we get into the river the better the water, we ought to surely put in our own system.

Mr. CASGRAIN. What about your sewer system?

Dr. BEASLEY. There are four sewers entering into the Detroit River untreated. The population is between 2,500 and 3,000. The town extends about 2 miles on the river front. It is the adjoining municipality to Windsor.

Mr. GLENN. There is no treatment of the sewage at all?

Dr. BEASLEY. No treatment whatever. Occasionally we have complaints about the chlorine in the water.

Mr. CASGRAIN. Would you agree to the following paragraph, which I find in the fundamental principles laid down by the sanitary engineers in New York, on June 27 of this year:

6. While realizing that in certain cases the discharge of crude sewage into the boundary waters may be without danger, it is our judgment that effective sanitary administration requires the adoption of the general policy that no untreated sewage from cities or towns shall be discharged into the boundary waters,

Dr. BEASLEY. I agree with that.

Mr. CASGRAIN. You are of opinion that no untreated sewage should be thrown into the Detroit River?

Dr. BEASLEY. If you have the raw sewage dumped into the river and if you drink that water you are liable to get typhoid.

Mr. CASGRAIN. You think the sewage should be treated in all cases?

Dr. BEASLEY. Yes.

Mr. CASGRAIN. You can not agree with the paradox that Dr. Cruickshank gave us?

Dr. BEASLEY. If I could, then we would put in our own water system in Sandwich.

Mr. CASGRAIN. If the commission came to the conclusion to recommend certain measures to do away with the pollution of the Detroit River, by works which would have to be undertaken by the municipalities, would there be a revolution of feeling in the town of Sandwich, for example?

Dr. BEASLEY. I think possibly there would be, although not as much now as 10 years ago.

Mr. CASGRAIN. The people are generally, I suppose, getting interested in the fact that it has become necessary not to dump the sewage into the Detroit River?

Dr. BEASLEY. Yes.

Mr. GLENN. Do you have much typhoid in your town?

Dr. BEASLEY. Not a great deal. We had possibly half a dozen cases this year, where they had been using the town water. One other family was not using the town water, and the whole family was taken with typhoid. In that case we could not determine where the source of infection was, unless it was from a well, but before we could have the water of the well examined they had half filled it with lime.

Mr. CASGRAIN. I thank the municipal authorities of Windsor, Sandwich, Belle Riviere, Amherstburg, Walkerville, and the others who came forward this morning to lend us their help in the determination of this very important question, which was submitted to the commissioners. As Mr. Glenn says, we have been received with the greatest courtesy, and we appreciate your kindness and courtesy and the help you have given to us.

Mr. HOWELL (mayor of Windsor). I may say that we are only too glad to have you amongst us, and we trust that your visit may be helpful to us and to the other communities which you will visit.

The commission then adjourned to meet at Port Huron, to-morrow morning, Friday, October 2.

INTERNATIONAL JOINT COMMISSION,
Port Huron, Mich., Friday, October 2, 1914.

The International Joint Commission met at Port Huron, Mich., on Friday, October 2, 1914, in pursuance of the consideration of the reference in relation to the pollution of boundary waters.

Present: Canada—T. Chase Casgrain, K. C.; Henry A. Powell, K. C.; Charles A. Magrath, Lawrence J. Burpee (secretary). United States—Obadiah Gardner (presiding), R. B. Glenn, Whitehead Kluttz (secretary).

After the adjournment for luncheon, the hearing in Port Huron was continued by Mr. Gardner (presiding) and Mr. H. A. Powell, K. C.

Mr. T. Chase Casgrain, K. C., Mr. Glenn, and Mr. Magrath proceeded to Sarnia, Ontario, in the afternoon, and held a session of the commission there.

APPEARANCES AT PORT HURON.

Dominion Government: Dr. Montizambert, C. M. G., superintendent general of public health.

United States Government: Dr. Allan J. McLaughlin, of United States Public Health Service, and Prof. Earl B. Phelps.

Province of Ontario: Mr. F. A. Dallyn, representing the Provincial board of health.

Municipalities represented at Port Huron: Port Huron—John L. Black, mayor; David Monteith, commissioner of parks and bridges; Earl Whitmore, city engineer; Dr. William Duff, medical health officer; Burt Cady, city solicitor; George Ernst, financial commissioner; Otto Hill, superintendent of public works. St. Clair municipality—Max Jennings, mayor; Dr. J. W. Inches, delegated by council. Algonac municipality—H. B. Gunnis, president of the village; C. C. Smith, of the village committee. Marine City—G. W. Becker, mayor of Marine City; John W. Breining, city attorney; Edward E. Degurse, city physician.

Mr. GARDNER (presiding). Gentlemen, in the absence of the chairman of the American section of this commission, it devolves upon me to preside at this meeting. Before entering upon the work of the commission I wish to digress for a moment to say that my coming

here to Port Huron at this time brings back some very vivid and peculiar recollections on my part. Possibly many of you are not aware of the fact that Michigan, as a State, owes its principal claim to greatness from the fact that I was born in this very county myself. As my mind goes back to the early days of my life, I remember very distinctly that I thought the proper way to ride one of your immense saw logs, that used to float down Black River at that time, was to sit down on the log and keep it from rolling in the water. The consequence was very disastrous to myself, as I made a hole in the water, and as I looked at the stream last night, crossing the bridge, I could imagine I saw that hole there yet. The one thing that has fixed itself upon my memory more clearly than anything else is that my grandfather was kind enough to assign to me a small portion of land for my special use and I sowed it with what was known in those days as Canada peas. I succeeded in raising a bushel and a half of peas, and one of my friends had a pair of red-topped boots that appealed to me very strongly. I have thought since that he had some vindictive purpose in mind, but at all events I exchanged the bushel and a half of peas for these boots. It came to the Fourth of July, and there was an excursion from Port Huron to Detroit, and I decided to make the trip, and when I undertook to install my feet in these boots I found they were two sizes too small, and the only way I could get my feet into them at all was by soaping them with what our grandfathers used to call "soft soap" and putting them on without stockings.

It was a very warm day, and, after having purchased my ticket to Detroit and return, I had 25 cents with which to see the town. I had a little, short, linen duster, and upon my entry into Detroit I purchased a packet of Indian crackers and put them in the inside pocket of the duster and started out to do the town, but some villain—I never learned who—placed a match in my pocket and I suddenly became a living volcano. The result was very disastrous to my coat, because it burned one side nearly off and half the sleeve, and I suffered terrific tortures because of these boots and the burned coat. On my return from Detroit, when near Port Huron and in the quietness of the night, I took the boots off and left them there, and went without them from that on.

I mention this experience of my early youth only to point to the fact that I noticed the tremendous development that has occurred in Port Huron and up and down the river since those days. It was a common thing in those days to see a little tugboat pushing its way up through the rapids of the river with several small schooners in tow. That has all disappeared, and in their place great freight steamers traverse those waters.

I want to point out that there appears to be some misapprehension about this commission and its work as reported in the newspapers. It seems to be confounded with the International Waterways Commission. It is entirely separate and distinct from that commission. The work of this commission is of a different character, and it was brought into existence by a joint treaty between Great Britain and the United States. In many of the functions of this commission as authorized by the treaty its decision is final, but in the present issue, as to whether or not the boundary waters

are being polluted to the injury of the health or damage of any of the people on the other side of the line, the Government has referred the question to us to investigate and determine and report our findings on. Whatever recommendations this commission may finally make to the respective Governments will not impose upon either Government the obligation of adopting them. The Governments may amend them or change them in any way they please. In order to bring before this meeting and to make clear the object which has brought us here to-day, I will read the letter that has been addressed to your mayor and to the mayors of other municipalities by the secretaries of the commission:

SEPTEMBER 3, 1914.

DEAR SIR: I am directed by the International Joint Commission to notify you officially, as mayor of Port Huron, that under the treaty between the United States and Great Britain signed at Washington, January 11, 1909, it is provided by article 4 as follows:

"It is further agreed that the waters herein defined as boundary waters and waters flowing across the boundary shall not be polluted on either side to the injury of health or property on the other."

On the complaint of the people of both Canada and the United States that this provision of the treaty was being violated, the Governments of the United States and Canada, on August 1, 1912, under article 9 of the treaty, referred to the International Joint Commission for investigation and report with its conclusions and recommendations the following questions:

1. To what extent and by what causes and in what localities have the boundary waters between the United States and Canada been polluted so as to be injurious to the public health and unfit for domestic or other uses?

2. In what way or manner, whether by the construction and operation of suitable drainage canals or plants at convenient points or otherwise, is it possible and advisable to remedy or prevent the pollution of these waters, and by what means or arrangement can the proper construction or operation of remedial or preventive works, or a system or method of rendering these waters sanitary and suitable for domestic and other uses, be best secured and maintained, in order to insure the adequate protection and development of all interests involved on both sides of the boundary, and to fulfill the obligation undertaken in article 4 of the waterways treaty of January 11, 1909?

In order to answer the questions set forth in the first branch of the above reference, an extensive field investigation to determine the origin, degree, and extent of the pollution of these boundary waters was carried out by the commission in 1913. The facts of pollution having been ascertained, as shown by the accompanying progress report, there remains for the commission, in answering the second branch of the reference, to investigate and determine what remedies should be recommended to the two Governments for the pollution found to exist and the means of applying and maintaining such remedies.

Under the plan adopted by the commission for the conduct of the investigation of the second branch of the foregoing reference the following steps are necessary:

1. Securing opinions from leading sanitary engineers upon questions relating to general policy and consultations with the sanitary engineers and sanitarians to be employed by the commission.

2. Hearings to enable all interested parties to present their views and facts as to what remedies they would advise and are capable of installing and maintaining, hearings to include any expert testimony submitted.

3. The collection of all available knowledge and data bearing upon the most approved methods of water purification and sewage treatment.

4. Formulation of advisable requirements for each locality, according to local conditions and necessities as shown to exist as the result of the investigation by the commission, and the report of the sanitary experts on the pollution of the boundary waters between Canada and the United States.

Accordingly, the commission has obtained the opinions of six eminent sanitary engineers, Messrs. George W. Fuller, Earle D. Phelps, and George C. Whipple, for the United States, and Messrs. F. A. Dallyn, W. S. Lea, and Theo. J. Lafreniere, for the Dominion of Canada. The testimony of these experts established

the broad fundamental principles upon which any remedial action must be based, and indicated clearly the procedure which should be followed by the commission.

The commission has now reached the very important step in the plan of procedure providing for hearings to enable municipalities and all interested parties to present their views and facts, including such expert testimony as they may desire to present, as to what remedies they would advise and are capable of installing and maintaining, that will prevent or remedy the pollution which now exists in contravention of the provisions of the treaty above referred to.

For the purpose of affording your municipality and its representatives an opportunity to be fully heard in respect to the prevention or remedies for the pollution of the waters of the Niagara River by the discharge of sewage of your municipality in said river, the International Joint Commission will meet in the city of Port Huron on Friday, the 2d of October.

For the convenience of the commission it was suggested that in the meantime you select such representatives of your municipality as you may deem advisable to prepare and present such plans for sewage disposal or treatment as in their judgment would adequately meet the requirements of the foregoing treaty in respect to the pollution of said river.

For your convenience and use in preparing for this hearing, I am sending you under separate cover:

1. Copy of the treaty and rules of procedure.
2. Copy of the progress report on pollution of boundary waters, including the report of the sanitary experts.
3. Copy of the resumé of testimony of consulting sanitary engineers.

Yours, truly,

SECRETARY.

I may say that a similar notice has been sent to the other adjoining municipalities on this side of the river.

Mr. CADY (city attorney, Port Huron). Before making any statement concerning this matter, it is not out of place to say to the honorable members of this commission that the citizens of Port Huron feel honored by having you with us. We feel especially honored in having among your commissioners, as the acting president, a product of this county. We welcome Senator Gardner back to his native county, and we say to him that we wish he could remain with us for two or three days to visit the scenes of his childhood and to see how the agricultural district has grown rich, doubly so by being honored by his birth. I feel that the citizens of Port Huron would be wanting in their duty if they did not make some mention of this fact.

Port Huron has a raw sewer system, all of which is emptied into the St. Clair River, and we can not deny but that there is pollution from the emptying of that sewage into the river. The extent of that pollution we are not able to state, nor can we state the effect of that pollution upon the water supply of other cities and towns to the south. We have not made any effort to do anything to change our sewerage system. I make this statement so that it may possibly save my answering some questions.

We have made, as I say, no systematic effort to change our sewerage system. In fact, we did not know what would be required, if anything would be required. We have come here to-day prepared to establish certain facts before this body. One of the first facts we will bring up will be our financial condition, which will consist of a statement showing the assessed valuation of our city, the amount of our bonded indebtedness, and the maximum amount of the bonded indebtedness we can carry under the law. We will also show the rate of our taxation. We will follow that by the engineer, who has prepared three exhibits, one which shows the sewerage system of the

city, another a detailed statement showing the length and size of the various sewers constituting the present sewer system, and the third a map of the city showing, in a general way, the extent of the sanitary sewer system which it would be necessary for the city to construct if it is required to treat the sewage. We will introduce these exhibits, and after they have been shown, if there is any question the commissioners see fit to ask the officials are here to answer these questions. In addition to the officials we are honored by the presence of 30 or 40 of our most influential citizens, who take a deep interest in the subject and who will be pleased to answer any question you may see fit to ask. May I ask the commission if it would be out of place for any of these citizens, if they deem it necessary, to ask the commission a question as we proceed?

Mr. GARDNER. Not at all.

GEORGE L. ERNEST (commissioner of finance) was examined by the city attorney:

Mr. CADY. You are the commissioner of finance of the city?

Mr. ERNEST. Yes, sir.

Mr. CADY. The city is under a commission form of government. There is the finance commissioner, the public safety commissioner, the commissioner of public works, the commissioner of parks and cemeteries?

Mr. ERNEST. Yes.

Mr. CADY. Have you prepared a financial statement regarding the city of Port Huron?

Mr. ERNEST. I have.

Mr. CADY. Have you that statement in your hand?

Mr. ERNEST. I have.

Mr. CADY. Will you hand it in?

Mr. ERNEST. Yes.

(The following is the financial statement):

City of Port Huron, Mich., 1914.

Assessed valuation-----	\$11,910,735.00
Bonded indebtedness-----	790,200.00
Bonded indebtedness allowed under act 279 of the year 1909, as amended, 8 per cent of assessed valuation-----	952,858.00
Annual interest on outstanding bonds-----	52,500.00
Amount legally raised by taxation for municipal purposes, 1½ per cent of assessed valuation, annually (this amount barely covers fixed charges and maintenance)-----	178,661.00
Tax rate per thousand, 1913:	
City-----	\$17.75
State and county-----	7.78
	<hr/> 25.53

Mr. GARDNER. What is the basis of your valuation, cash value, or what?

Mr. ERNEST. It is supposed to be about cash value; that question would be answered better by the city assessor.

Mr. GARDNER. I thought you would have a uniform system as they have in some cities?

Mr. ERNEST. No, the assessment is done by an assessor appointed by the commission, and he supervises the value of the property. He takes an oath to do it at true cash value.

Mr. POWELL. Have you any substantial floating indebtedness?

Mr. ERNEST. No, sir; our floating indebtedness does not amount to anything. The bills are passed as they mature and paid. The charter provides, however, that we can raise a certain amount fixed by the commissioners themselves, for a sinking fund each year, not to exceed \$20,000, but so far we have been unable, owing to the increased cost of maintenance in the city, to put much in the sinking fund. There is a margin of \$172,000 which we can issue under the statute.

Mr. GARDNER. Is your outstanding bonded indebtedness long-time bonds?

Mr. ERNEST. There are a number of 30-year bonds still in existence. There are a certain series falling due, beginning next year, that we must provide for. The tax rate includes the school tax, which is fixed per capita. We can not use any of the school tax for municipal purposes.

Mr. POWELL. Your taxation is of three kinds?

Mr. ERNEST. Yes.

Mr. POWELL. Do you issue financial statements annually?

Mr. ERNEST. Yes.

Mr. POWELL. Would you supply us with 10 copies of the last financial report of the city?

Mr. ERNEST. Yes.

Mr. POWELL. What is the population of the city?

Mr. ERNEST. The last Federal census gave us 18,863, but that was taken in 1910.

Mr. CASGRAIN. Is the population increasing?

Mr. ERNEST. Our school census makes it about 21,000.

EARL WHITMORE (city engineer of the city of Port Huron) examined by the city attorney:

Mr. CADY. Have you prepared for the use of this commission certain exhibits at the request of the city commission?

Mr. WHITMORE. Yes, sir.

(Mr. Whitmore produced maps of the present sewer system of Port Huron, showing the different directions of the sewers, the size and location of the sewers.)

Mr. POWELL. Have we not that map in the report?

Mr. WHITMORE. The map in the report shows only the outlets of the sewers, where they enter into the river. On the north side of Black River, our principal sewer is in Kent Street, running a distance of about a mile and a half.

Mr. POWELL. How many points of discharge?

Mr. WHITMORE. More than a dozen—about fourteen.

Mr. POWELL. What is your daily consumption of water?

Mr. WHITMORE. About 9,000,000 gallons for all purposes.

Mr. POWELL. Substantially, you have a natural discharge of 9,000,000 gallons of sewage, and in addition to that you have the storm sewage?

Mr. WHITMORE. Yes.

Mr. POWELL. Have you a combined system or not?

Mr. WHITMORE. A combined system.

Mr. POWELL. Do you propose to continue that?

Mr. WHITMORE. Undoubtedly, until we are compelled to do it differently.

Mr. POWELL. I am not suggesting that it is a bad system, but I would like to have your intentions.

(Mr. Whitmore produced Exhibit 2, statement of the length and size of the present sewers, showing the length of tiled sewers, etc.)

Mr. Whitmore produced as Exhibit 3 map of the city of Port Huron, showing the general extent of the sewer system, which would have to be built, if the city were compelled to treat its sewage, in any more extensive manner than merely to screen it.)

Mr. WHITMORE. If we were compelled to treat our sewage extensively we would have to have an entirely new sewerage system.

Mr. POWELL. Could you get the existing main running along the river?

Mr. WHITMORE. If we were to do that it would have to take all the storm water and it would not be practical to treat all the storm water in our plant if we were to do any more than screen out the grosser parts.

Mr. POWELL. There is an ambiguity about the term "purification plant;" it all depends on the degree of purification. What do you purpose doing? What was in your mind in the way of purification? Was there anything further than sedimentation and fine screening?

Mr. WHITMORE. I have prepared a general statement of our position, which, I think, would bring out that point more clearly than I could in direct answer to your questions.

(Mr. Whitmore then read the following statement:)

To the honorable, the International Joint Commission, on the reference by the United States and Canada in re the pollution of the boundary waters, etc.

GENTLEMEN: We are submitting herewith for the information and use of your honorable body certain exhibits, as follows:

Exhibit No. 1, a map of the city of Port Huron showing the present sewer system.

Exhibit No. 2, a tabulated statement showing the length and size of the various sewers constituting the present sewer system.

Exhibit No. 3, a map of the city of Port Huron showing, in a general way, the extent of the sanitary sewer system which it would be necessary for the city of Port Huron to construct if required to treat the sewage.

We also beg to submit the following general statement of the position of the city of Port Huron with reference to this matter:

To remedy or prevent the pollution of the water of the St. Clair River by sewage from the city of Port Huron, it would obviously be necessary either to treat the sewage in some manner or to discontinue the use of our sewers as sanitary carriers.

To discontinue the use of the sewers is, of course, impracticable, since to do so would cause incalculably greater damage to public health and convenience than could possibly be occasioned by the present practice.

It remains, then, to inquire whether it is possible and practicable and necessary to treat our sewage in a manner that will eliminate or appreciably reduce the pollution.

As our sewers are of the combined system, carrying both sanitary sewage and storm water, it would be impossible, without the construction of an entire new sanitary sewer system, to treat our sewage except by the screening method, removing only the larger solids. It would be possible to screen the sewage from our present sewer system, if it is shown that any adequate benefit would be derived. Such screening would probably remove 15 per cent of the suspended matter from the sewage, 10 per cent of the organic matter, and 15 per cent of bacteria. But it would be necessary for the down-river towns to purify their water supply, and since the water must still be purified it does not appear that any very great material benefit is to be derived by the screen-

ing of the sewage, unless it is found that the present pollution is so great as to make proper purification of the water impracticable and that this degree of sewage purification would make the water purification more practicable or more economical, and these conditions do not seem to obtain.

To effect any more complete purification of our sewage, whether by sedimentation, septic treatment, chemical precipitation, contact filters, sprinkling filters, or intermittent sand filters (which comprise practically all the methods of sewage treatment now in practice), would necessitate the construction of an entire new sanitary sewer system. Moreover, the greater grades required for the proper operation of these small sanitary sewers, as compared with the flat grades permissible in the large combined sewers, would necessitate the pumping of practically all of our sanitary sewage at different points. Also if a method affording a high degree of purification be insisted upon, such as intermittent sand filters, the absolute lack of a sufficient area of low land available for the purification plant would necessitate the pumping of all the sewage to a high elevation for treatment, the purchase of a large area of land would be necessary, and the construction of a very expensive purification plant thereon.

The peculiar shape of the city of Port Huron, stretching along the St. Clair River and the lower end of the Lake Huron for a distance of over 7 miles, with the remote South Park, Tunnel, Campau, Fort, and Beach districts, makes it an excessively expensive city to sewer as well as to provide with other public improvements. Notwithstanding this, the city is so thoroughly sewered that scarcely 5 per cent of the dwellings are unsewered; and other improvements—pavements, sidewalks, water mains, etc.—have kept pace with the development of the city. The burden of the expense incurred for these various improvements and for their proper maintenance and for additional improvements coincident with the normal growth of the city will be all that a city of limited resources such as Port Huron can reasonably expect to be able to carry; and to impose such a burden as the construction of a second sewer system, with extensive purification works, would be to confiscate our homes. The cost of the house connections alone to detach the houses from the present system and connect with the new would amount to fully a quarter of a million dollars—5,000 houses at \$50 each, not to mention the immense cost of the new sewer system, purification plants, pumping station, etc. The present bonded indebtedness of the city is very near the limit fixed by the State law, owing to the various expensive improvements already made, as outlined above.

The new sewer system indicated on the map, Exhibit No. 3, including 70 miles of sewer with necessary manholes, etc., sewers from 8 to 25 feet in depth and from 8 to 24 inches in diameter, would cost about \$500,000, not including pumping stations and purification plants, the cost of which would depend largely upon the extent of the purification required, but would probably be not less than \$200,000, with an operating cost of \$50 per day and large maintenance expense. This means a total first cost of practically \$1,000,000—an utterly impossible figure for a city such as Port Huron. And if the more complete method of purification, such as intermittent sand filtration, were required the cost would be still greater.

But the more important question is not so much whether or not Port Huron can afford to treat its sewage as whether or not it ought to be done. Not one of the so-called purification methods in use at present actually purifies the sewage, though intermittent sand filtration, with suitable preliminary treatment, approaches it; and even a purification plant of this kind may be allowed to get into such condition with a single week of carelessness or incompetent management that it can not be made to operate properly for months. It is self-evident, then, that even after providing means for purifying our sewage to highest possible degree, it would still be necessary for the down-river towns to purify their water in order to be assured of having it safe at all times. So that even with this enormous expenditure we do not seem to have made much headway toward safeguarding the public health.

The sterilization of water by the use of the hypochlorite treatment is an extremely expensive and efficient operation, and we do not understand that the pollution of the great St. Clair River by the Port Huron and Sarnia sewers is sufficient, or likely to become so in the near future, to prevent the efficient use of this system of water purification by the nearest of the down-river towns which draw their water supply from the St. Clair River. We are aware that some sanitary authorities have classed the hypochlorite method of sterilizing water as a makeshift, suitable only for temporary or emergency use, on

account of the fact, as they state, that the system is dependent for its successful operation on the faithfulness of its attendant, but it is difficult to produce anything that is not dependent to a greater or less degree upon the faithfulness of the attendant, and we have pointed out that a sewage filtration plant is infinitely more dependent upon the faithfulness and efficiency of its attendants than a chlorination plant, since the former may in a short time be so neglected or misused that it will not operate properly again for a long time, whereas a bungle in the operation of the latter may be corrected as soon as discovered.

In this connection we would like to quote briefly from a paper prepared by Mr. George C. Whipple, and read before the American Public Health Association in 1912:

"Using the words in their most obvious meaning, let us ask the question, Ought the sewage of our American cities be treated in some way before being discharged? Generally speaking, yes. They are relatively few instances where raw sewage can be discharged into streams or lakes without causing objectionable local conditions or dangers of a sanitary character. The nature of the treatment required will vary all the way from a mere straining out of the grosser solids to a combination of processes that result in actual purification.

"To take an illustration from practice, can the water supplies of our lakes be protected by purifying the sewage that enters them? Many laymen think so, and ardently advocate the construction of sewage purification plants and oppose water filtration. Would they say the same if they realized that most so-called sewage purification plants only partially remove the dangerous substances from the sewage, and that complete removal is impracticable on account of the expense and the almost insuperable difficulty of treating all of the sewage at times of storm? Would not these well-meaning people have a clearer conception of the problem, if instead of using the broad misleading word 'purification' we used the term 'sewage treatment,' or, still better, some word that described definitely the results accomplished by the different processes?

"Taking the cost of efficient water purification as \$10 per 1,000,000 gallons, and allowing a per capita water consumption of 100 gallons per day, the process pays for itself if it reduces the typhoid fever death rate of 4 per 100,000.

"No such record can be shown for the purification of sewage except perhaps in the case of a few small plants built for the protection of the water supply of some large city, and even here it is difficult to measure the number of lives that have been saved. The complete diversion of sewage from the drainage of a public water supply has repeatedly been of hygienic benefit. So has the introduction of sewer systems in cities and towns where none existed before. But the purification plants that have been constructed for the large cities of the world have not the saving of many human lives to their credit, so far as the best available evidence shows. The reason is obvious. They have not, as a rule, been built for that purpose, popular ideas to the contrary notwithstanding.

"Sanitarians abroad have long recognized the fact that river water supplies can not be protected against the danger of infection by any of the known methods of purifying sewage discharged into the river above the waterworks intake. Instead, they depend upon the filtration of the water supplies themselves. In Germany, the filtration of surface water supplies is required by law and no difficulty has been found in building water filtration plants capable of purifying the water after it has received what would be regarded in this country as a large amount of sewage. In Germany and in England, sewage disposal works are built primarily to remove organic matter and prevent streams from becoming foul. Therefore, when public health authorities in this country compel large cities to construct sewage-purification plants for the avowed purpose of protecting water supplies taken from rivers below them, they are attempting to accomplish the impracticable and are compelling the expenditure of money without adequate returns. The most that can be expected in this direction is to lessen the burden placed upon the water filters, and in some instances this may be desirable.

"It would not be right to balance the cost of sewage purification against the saving of human lives, were it not for the fact that our cities are subject to debt limits and that money is needed for other purposes that affect the public health, for cleaner streets, for better care of schoolhouses, for parks and playgrounds, and for the special needs of the department of health in securing safer milk and food supplies, and for all sorts of hygiene and sanitary inspection. In view of the steadily increasing taxes in our large

cities, it behooves sanitarians to find out for each city in which direction money allotted to the saving of human lives will do most good. In other words, how can the most lives be saved for a dollar. Whatever the answer may be, it is not likely to be found in the purification of sewage."

The position which we have endeavored to set forth in this communication is briefly this: First, that the cost of extensive sewer purification for Port Huron would be prohibitive, owing to the unfavorable topographical and geographical conditions, and, second, that even with the Port Huron and Sarnia sewage purified to the highest degree, it would still be necessary for the nearest down-river town, as well as those more remote, to filter or sterilize their water in some manner, in order that they may be assured of safe supply; and, third, that the present pollution of St. Clair River, by the cities of Port Huron and Sarnia, has not been shown to be sufficient to prevent or interfere with efficient and economical filtration or sterilization of such water supplies.

All of which is most respectfully submitted.

MAYOR.

CITY COMMISSIONER.

E. R. WHITMORE,
City Engineer.

Mr. GLENN. How do you treat your water?

Mr. WHITMORE. Hypochloride.

Mr. GLENN. Where do you get your water?

Mr. WHITMORE. The St. Clair River.

Mr. GLENN. And you treat it with hypochloride to prevent impurities?

Mr. WHITMORE. Yes.

Mr. GLENN. What is the condition of that water before you treat it?

Mr. WHITMORE. Except during storms it is clear and free from sediment, but at times the analysis is bad.

Mr. GLENN. Have you any large cities above you?

Mr. WHITMORE. Not near us.

Mr. GLENN. To what extent do you have to use the hypochloride?

Mr. WHITMORE. From 5 pounds to 9 pounds to the million gallons.

Mr. GLENN. Do you have any complaints as to the smell from the water?

Mr. WHITMORE. Only a little at first; we do not have any complaints now.

Mr. GLENN. You have no large cities above you, but you treat your water for the purpose of preventing any injury to the health of your people here?

Mr. WHITMORE. Yes.

Mr. GLENN. You are a city of 25,000 people and you dump your sewage raw into the river above the municipality of St. Clair and other towns which are just below you?

Mr. WHITMORE. Yes.

Mr. GLENN. Do you think it is right that that should be done without some kind of treatment; does not that appear to place a heavy burden on the municipalities below you?

Mr. WHITMORE. The idea that we have tried to bring out is that even if we were to purify our sewage it would still be necessary for them to purify their water?

Mr. GARDNER. Have you read the report of our experts which we have sent to you?

Mr. WHITMORE. No.

Mr. GARDNER. The object of their recommendation is to try and divide the burden to a certain extent. If you treat at the output and they treat at the intake then the burden would not be so heavy.

Mr. GLENN. Do you think it right that the offending party should do no treatment and that the unoffending party should have to do it all?

Mr. WHITMORE. Has it been shown that they could treat their water much less expensively?

Mr. GLENN. Yes; if you give your sewage some treatment. It is more expensive on them if you give your sewage no treatment.

Mr. WHITMORE. I am not so sure about that. If they have to treat their water, even though we treat our sewage, it would not necessarily make it cheaper for them.

Mr. GLENN. You take the position then that raw sewage dumped into the river without any treatment does not place on the cities below you a greater burden than if you first treated the sewage before you poured it into the river?

Mr. WHITMORE. It would still be necessary for them to treat their water.

Mr. GLENN. Certainly; but it would not be necessary for them to treat their water to the same extent.

Mr. WHITMORE. I think so; it would have to go through the same process, which would not be any less expensive.

Mr. GLENN. Are you people opposed to treating your sewage?

Mr. WHITMORE. Only in the sense that the expense would be prohibitive. We are not opposed to it as a general proposition.

Mr. CASGRAIN. Have you seen the summary of the opinions given by our expert engineers?

Mr. WHITMORE. No.

Mr. CASGRAIN. For instance, in paragraph 6, they say:

6. While realizing that in certain cases the discharge of crude sewage into the boundary waters may be without danger, it is our judgment that effective sanitary administration requires the adoption of the general policy that no untreated sewage from cities or towns shall be discharged into the boundary waters.

Do you agree with that?

Mr. WHITMORE. I do in one sense. Of course it is offensive to anyone if any sewers are discharged into water the people are going to drink. As an economic proposition I do not agree with it, if that statement means that the treatment of our sewage would effect a saving in money to the people down the river in treating their water.

Mr. CASGRAIN. I see you produced a plan there of which might be done. What is the system that that plan represents? I did not gather from the reading of your report that you described the system.

Mr. WHITMORE. This is merely intended to represent the extent of the sewers that we would have to build if we were required to install a separate system for sanitary sewers and for storm water. It does not outline any definite system of treatment.

Mr. CASGRAIN. Our sanitary engineers express this opinion also in paragraph 9:

9. In general no more elaborate method of sewage treatment should be required than the removal of the suspended solids by fine screening or by sedimentation, or both, followed by chemical disinfection or sterilization of the clarified sewage.

Except in the case of some of the smaller streams on the boundary, it is our judgment that such oxidizing processes as intermittent sand filtration and treatment by sprinkling filters, contact beds, and the like, are unnecessary, inasmuch as ample dilution in the lakes and large streams will provide sufficient oxygen for the ultimate destruction of the organic matter.

What have you to say as to that?

Mr. WHITMORE. Fine screening would be possible without any great expense, but the sterilization of the effluent would hardly be practical during storms.

Mr. CASGRAIN. Have you heard any complaints about the method of dumping your sewage into the river here from the cities below you on this side, or from the cities below you on the other side?

Mr. WHITMORE. I do not think any formal complaint has ever been made to the city of Port Huron, so far as I know. We have reason to believe that some of the towns immediately below us do not think it is the proper thing to do.

Mr. GLENN. Your people are willing to adopt any method of purifying your sewage that is consistent with your ability from a financial point of view?

Mr. WHITMORE. I have not any doubt that is true.

Mr. GLENN. I should judge that from what Mr. Cady said in his opening remarks.

Mr. CADY. I repeat that statement. I do not want you to get any wrong idea. I am not here saying it is proper to put raw sewage in this river. We do not want to do it. We want to especially call your attention to our financial condition, so that you will not recommend something we can not comply with.

Mr. CASGRAIN. You are perfectly right.

Mr. POWELL. You want the wind tempered to the shorn lamb. Taking your storm water, what is the amount of precipitation—do you know?

Mr. WHITMORE. I can not give you that from memory.

Mr. POWELL. What is the acreage of your city?

Mr. WHITMORE. It is in the neighborhood of 6 square miles. I can not say definitely. The area of our city is very much in proportion to our population. [Explaining on map.] Here is the residence district away down here, and a couple of miles out is another residence district, and then we have a central residence district.

Mr. POWELL. Are some landowners holding unimproved properties?

Mr. WHITMORE. I guess if they could sell it they would be glad to get rid of it. There are two more residence districts up here, so that all kinds of improvements in the city are expensive.

Mr. POWELL. You have no idea what the amount of surface water would be in proportion to the amount of sewage that is put into the river?

Mr. WHITMORE. Only that it would be enormously large, on account of our large area and small population. We have several storm sewers here, for instance, that are 5 feet to 8 feet in diameter, and which at certain times of the year flow practically full. Of course our ordinary sewage would all go through 20 to 24 inch sewers easily.

Mr. GLENN. I want to disabuse you, gentlemen, of the idea that we have any desire to put any burden on the city that can not be borne. All we ask is that the citizens should cooperate with us, as

far as they possibly can, to bring about such a system as can be undertaken by them in order to prevent the pollution of the river below. That is the object of this commission. If fine screening, together with treatment of water, will be sufficient, so much the better. We want the people on both sides of the line to be perfectly fair to each other, so that we can get at a thorough understanding.

Mr. CADY. We stand ready to cooperate in every way possible.

Mr. WHITMORE. We saw that from looking over your proceedings at Detroit. Mr. Cady cautioned me on that point. I did not intend my report to show that the city was against any reasonable proposition.

Mr. GARDNER. You do not believe it is proper and right for you to discharge raw sewage into the river?

Mr. WHITMORE. I do not think it is wrong from the standpoint of public health, but from an esthetic standpoint it is not just the thing.

Mr. GARDNER. Do you have any considerable amount of typhoid here?

Mr. WHITMORE. We have not, within the last few years.

Mr. GLENN. Has the percentage of typhoid been reduced since you commenced to treat your water with hypochloride?

Mr. WHITMORE. Yes; very much.

Mr. GLENN. That showed the water was in a bad state before you commenced to treat it?

Mr. WHITMORE. Yes.

Mr. POWELL. You referred to the fact, which is unquestionably true, that even supposing this city were not in existence at all, or being in existence that it made its sewage effluent as pure as distilled water, the communities below would still have to purify their water at the intake; but don't you see that if the river water is impure, you are adding to that impurity by depositing your sewage in it. I think you will qualify your statement, because if you put your sewage in they will have to do greater purification, which means more cost.

Mr. WHITMORE. I do not think it means more cost necessarily. The water must be treated by a certain method, either by filtration or chlorination, and the amount of impurities, providing they are all in a dissolved state, might not necessarily affect the cost.

Mr. POWELL. You are aware as a sanitary engineer that the larger the particles of sewage allowed to go into the water the more inefficient is the process of chlorination?

Mr. WHITMORE. I do not think that our sewage brings any large particles to the down-river towns. We know there are some, but we think they originate at nearer points from boats and from the summer resorts which line the shore. We think our sewage, by the time it reaches the nearest of the down-river towns, is dissolved or settled to the bottom of the river.

Mr. POWELL. And assuming that, chlorination you think would be sufficient for you here, and that with your sewage going into the river it would be sufficient there to chlorinate. But do you not think you would have to supplement chlorination by other means?

Mr. WHITMORE. That may be true if it is shown that our sewage does reach the down-river towns in the State; if so, it might not be acted upon efficiently by chlorination, but I do not believe that is the fact.

Mr. POWELL. When you make the observation that your sewage here is more soluble than ordinary sewage, it is a hard proposition to prove. I think the excreta here would be about the same character as it would be at other points.

Mr. WHITMORE. What I meant to say was this, that the distance being considerable from here to the nearest of the down-river towns, our sewage would be precipitated or dissolved, whereas between Port Huron and the nearest down-river town, it is lined with summer resorts and residences, and they mostly sewer directly out into the river.

Mr. POWELL. So that you think the quantity of the water is sufficient to play an efficient part in purification?

Mr. WHITMORE. Yes.

Mr. GLENN. I read from the report before us that in 1911 the typhoid rate here was 48 per 100,000, and in 1912 the rate was 216 per 100,000. Since then, you have been treating with chloride, and the typhoid rate has been greatly reduced. Does not that prove conclusively that before treatment the water was in a bad condition, and you have done better since you commenced using chloride?

Mr. WHITMORE. Yes.

Mr. POWELL. What is your opinion on this proposition, that it would be the correct thing for your community not to impose on the lower riparian communities any greater burden than with the present condition of things is imposed upon your community by the water that comes to you?

Mr. WHITMORE. That seems right.

Mr. POWELL. That would look like fair play.

Mr. WHITMORE. That is certainly justice; we should not cause them any additional expense or danger to public health.

Mr. POWELL. Then it is a question of dividing the burden between the community here and the community below?

Mr. WHITMORE. From the economic standpoint, if it were found that Port Huron sewage does reach these down-river points in a form that it could not be acted upon by chlorination, so that they would have to build a filtration plant, it would be more economical for Port Huron to pay for that filtration plant than it would be to treat their sewage here.

Mr. GARDNER. To what do you attribute the source of pollution that comes to you?

Mr. WHITMORE. Some of it is our own. There is a little creek that comes in above the city that probably carries some pollution. The 1912 epidemic was apparently caused from the opening of the gates after our intake was closed with anchor ice. There was a later small epidemic from the same cause. The inshore water is shown to be very impure, as compared with that out in the stream where our intake is.

Mr. GARDNER. Have you any idea that any considerable impurity comes to your intake by reason of the steamboats and navigation on the rivers?

Mr. WHITMORE. At certain seasons of the year there undoubtedly is, but at the same time what records we have of disease do not seem to indicate that that has any great bearing, for the reason that our typhoid epidemics have not been during the navigation season to any extent.

STATEMENT OF MR. HENRY M. BURTON, SUPERINTENDENT OF THE WATERWORKS, PORT HURON.

Mr. CASGRAIN. You are superintendent of the waterworks of Port Huron?

Mr. BURTON. Yes.

Mr. GARDNER. What is your capacity; is the water obtained altogether by pumping?

Mr. BURTON. Yes.

Mr. GARDNER. None by gravitation?

Mr. BURTON. No.

Mr. GARDNER. Is your water clarified at the pumping station?

Mr. BURTON. The water reaches the well from the river, and the chlorination material is dumped into the well before it is taken into the intake pipe in the main pumps.

Mr. CASGRAIN. What quantity of chlorine do you use?

Mr. BURTON. Seven and a half and eight pounds per million gallons.

Mr. GARDNER. How long is it since you have been using chlorine for the purification of your water?

Mr. BURTON. I think it is about three years ago they started.

Mr. GARDNER. Do you know what difference there has been in the typhoid rate before you commenced to chlorinate as compared with since you commenced to chlorinate?

Mr. BURTON. I only know from statements I have heard that the sickness has been less since the chlorine has been used. I have not heard of any large number of typhoid cases lately; in fact, I do not think there is any in the city at present.

Mr. GLENN. How many gallons of water do you use?

Mr. BURTON. On an average from 7,500,000 to 8,000,000 gallons a day.

Mr. GLENN. What is that per capita?

Mr. BURTON. I do not know, but there is a great deal used in the factories; I should think that one-half of it is used in factories of various kinds.

Mr. GLENN. Does about that same number of gallons pass through the sewerage every day?

Mr. BURTON. I do not think so. Some of the plants sewer into the river instead of into the sewers.

Mr. GLENN. What is the nature of your manufacturing?

Mr. BURTON. Paper mills, machine shops, flour mills, and others.

Mr. POWELL. Have any of these independent sewers of their own?

Mr. BURTON. That I do not know.

Mr. POWELL. What do you do with your garbage?

Mr. BURTON. I do not know what the city does. I know that with my own garbage anything the chickens won't eat I burn it up.

Mr. CADY. We have a private concern that takes the garbage into the river.

Mr. CASGRAIN. It is not dumped into the river?

Mr. BURTON. No.

STATEMENT OF MR. DAVID MONTEITH, PUBLIC SAFETY COMMISSIONER OF PORT HURON, MICH.

The CHAIRMAN. Mr. Monteith, your title would indicate that you occupy a very important position in this community. I would ask you what your particular jurisdiction is?

Mr. MONTEITH. I have charge of the police department, the fire department, and the department of public health.

The CHAIRMAN. You are the administrative officer?

Mr. MONTEITH. Well, the commissioner is the administrative officer of all the departments. I would like to say that since the first of the year 1914 there has not been one death from typhoid fever. Before the 2d day of March, 1914, we had 18 cases of typhoid fever, none of them serious and none of them that resulted in death. At that time the gate at the waterworks well became opened for some reason and some infection got in. At that time the chlorination did not work as it had been working, but since then we have systematized the use of the chlorine, and there have been but three cases in the city since March 2, 1914, none of them from Port Huron, but from people who were taken sick elsewhere and brought here. We have not had any since March 2 that we could attribute to the water. Since the first of the year there has not been a death.

Reference has been made to the disastrous epidemic of typhoid that we had. Since the time referred to there has been a cement well constructed at the waterworks and the use of chlorine has been systematized to the point where we think we have it pretty nearly perfect. We have not noticed any typhoid that we could attribute in any way to the water.

The CHAIRMAN. Does that same condition apply to the towns below during the same period?

Mr. MONTEITH. I have no record for the towns below.

The CHAIRMAN. I did not think you had the exact records, but have you any knowledge that they have been as healthy below here during the same period as you have been here in Port Huron as regards typhoid fever?

Mr. MONTEITH. I do not suppose that anything we have done would result materially in any benefit to the towns below.

The CHAIRMAN. In your judgment, is it a judicious thing to do as regards the conservation of the health of the people down the river or on either side of the river to discharge raw sewage into the river?

Mr. MONTEITH. It is not.

The CHAIRMAN. You think that the sewage should be treated in some way before it is discharged into the river?

Mr. MONTEITH. I think we should do everything we can that is within our power to help benefit other cities as well as our own.

Mr. POWELL. You are not a medical man, are you?

Mr. MONTEITH. I am not. I suppose you will call upon our city physician for a statement.

Mr. POWELL. The death rate from typhoid fever may not be very significant. The physicians probably adopt the modern method of using toxine, which lessens the virulence of the disease. The presence is indicative more than the fatality when you are considering the effect of chlorination.

Dr. LOHSTORFER. The cause of our high death rate is the fact that we have a sewer that empties into the St. Clair River 75 feet below the waterworks, and the current there at Lincoln Avenue is upstream. Our city commission and the health department have not changed that sewer as the people of the city want it done. They want it diverted quite a distance farther south, but they have not done that so far. That condition caused our enormous death rate during the year that has been referred to. Since then we have built a cement well and we do not open the gates except when it is absolutely necessary. We have to chlorinate our water. We get no contamination from above. Our death rate is due entirely to the inefficiency of our commission and the health department in not using that sewer.

Mr. MONTEITH. At the time that the gate that I spoke of at our waterworks well was opened the up current which exists right near the shore evidently was the cause of some of the contamination we got in the water. The chlorine would not work at that time, and I think that the up current had considerable to do with the 18 cases of typhoid that we had before March 2. After March 2 the system was rearranged so that the gate was closed all the time, and we have not had but three cases, none of them from Port Huron.

Mr. GLENN. It is true that before you put in this well that that current carried the sewage back and caused greater sickness in the town, is it not?

Mr. MONTEITH. Yes, sir.

Mr. GLENN. So you were suffering from your own sewage and not from the sewage above you?

Mr. MONTEITH. Everybody thinks it was from our own sewage.

Mr. POWELL. If that were the effect of your sewage on your people, it would be quite as bad upon other people, would it not?

Mr. MONTEITH. Yes, sir.

Mr. GLENN. Has there been any complaint made to you by the officials or citizens of the towns below you?

Mr. MONTEITH. I do not think there has been any formal complaint made.

Mr. GLENN. But has the mayor or the health officer of those towns talked to you about the condition below here on account of your sewage?

Mr. MONTEITH. They have never talked to me; no.

Mr. CASGRAIN. Is it not common knowledge that they do complain?

Mr. MONTEITH. I have met people from St. Clair on the street who would make a little complaint, but it never happened to be the mayor or city officials down there. I know that they imagine that the city of Port Huron is to blame for it.

The CHAIRMAN. How far from the mouth of the lake is your intake?

Mr. MONTEITH. About 2 miles.

Mr. POWELL. How far in from the shore is the mouth of the intake?

Mr. MONTEITH. About halfway out in the river, I think; about 60 feet. It is about half a mile from the lake.

STATEMENT OF DR. WILLIAM DUFF, HEALTH OFFICER OF PORT HURON, MICH.

Dr. DUFF. If you gentlemen wish to ask me any questions, I shall try to answer them. I took office as health officer of Port Huron on the 2d day of March of this year.

Mr. MAGRATH. Who has to determine the quantity of chlorine that you use here?

Dr. DUFF. It was determined by the State sanitary engineer, Mr. Rich, of Lansing, Mich., who came here and took the figures and then notified the commissioner of public safety or the chief of the waterworks department as to the amount of chlorine to be placed in the water.

Mr. MAGRATH. Is it at all offensive in the water?

Dr. DUFF. Not at all, sir.

Mr. MAGRATH. Is it noticeable?

Dr. DUFF. It is not; that is, since this rearrangement has been made, it is not. Before that time the treating of the water for the last two or three years was more or less intermittent, the lime being admitted directly into the mains. It accumulated at the taps sometimes, and it was strong. The result was that there were some objections by the people. Attention was drawn to the commissioner of public works, who took the matter up with Mr. Rich, and Mr. Rich made the quantities which are in operation at the present time.

Mr. POWELL. You now inject the solution into the water instead of treating the raw material?

Dr. DUFF. Yes, sir.

Mr. POWELL. In the treatment of typhoid fever, of course, you have resorted to this toxine treatment?

Dr. DUFF. A great many physicians do; yes, sir.

Mr. POWELL. That is commonly believed to lessen the death rate?

Dr. DUFF. It is.

Mr. POWELL. It may not be a preventive of typhoid itself, but it lessens its virulence?

Dr. DUFF. I am not prepared to answer that. Whether my brother physicians use that method to any great extent or not, I do not know. Since I have been in office I have spoken to the commissioners and sounded them on the matter, and with a view to public safety I asked them what they thought about the city supplying the serum to the physicians for the treatment of these cases. They conceded that it was a very good idea, and agreed to do so.

Mr. POWELL. Our contingent was all inoculated with the serum before sailing.

Dr. DUFF. Well, you would not have gotten it here.

Mr. CASGRAIN. Do you believe it is a proper system to dump raw sewage into the river here, taking into consideration the fact that you have cities on both sides of the river?

Dr. DUFF. I would not, as a medical man, for fear of infection; certainly not. But, as Mr. Monteith said, there are but three cases of typhoid in the city at the present time. One comes from St. Clair below us. He had been visiting in the township, just outside of the city, and had been drinking from a well. On my inquiry he informed me that he had also been bathing in the river and perhaps

drinking the water. Anyway, he had been drinking colon bacilli from the river.

Mr. GLENN. You have not been here but two or three months?

Dr. DUFF. In the city?

Mr. GLENN. Yes.

Dr. DUFF. I have lived here 45 years, but I have been acting as health officer for only two or three years.

Mr. GLENN. Do you not know from what has been said here that the great typhoid rate that you had here in 1912 was caused by the current going back and bringing that pollution down into your water supply?

Mr. DUFF. I am pretty well along in years. I have been 30 years in the practice of medicine, but I have never been so dogmatic about things to think that I can not be mistaken. It may have been possible, as I have granted time and again.

Mr. GLENN. If that did not cause it, what did?

Dr. DUFF. The pollution and the infection of the waters coming down from the Lakes above to a more or less extent. All of this trouble from here out is not started from Port Huron, is it? Our lake waters do not show it. They are not pure and free from infection. Our boats going up and down left it with us.

Mr. GLENN. Then, if the condition of the river above you was not caused by your acts which brought about this terrific rate of typhoid fever before you commenced treating your water in the way you have, that terrible condition above augmented by your sewage would put these people below you in rather a bad fix, would it not?

Dr. DUFF. I suppose so. I blame Port Arthur and other communities for our trouble here. Whether all these cases reported were typhoid fever or not we are not aware. Possibly I did not understand correctly the statement that was made. Were there two hundred and some odd deaths from typhoid fever in Port Huron or were they simply typhoid-fever cases?

Dr. McLAUGHLIN. The statement referred to the number of deaths per hundred thousand population.

Dr. DUFF. Everything was ascribed to that. We used to call it typhoid malaria. We always had an epidemic and fear in the town.

Mr. GEORGE E. WARREN. Is it not true that the State was affected very largely by malaria at that time outside of the places where they had sewerage systems?

Dr. DUFF. We had a very large epidemic throughout the State. In that year Detroit's rate was a little lower than ours. I do not know about St. Clair and Marine City. It is possible that they have become infected from our sewage, but we hope not. There is no water turned on to the taps but what has been chlorinated. Everything has been more or less chlorinated. Our sewer that is running to-day, with all this pollution in it, is running into water that is chlorinated.

Mr. WARREN. What I wished to convey was that there was a considerable amount of typhoid fever during 1912 and the early part of the year 1912 inland throughout the State, where the waters of Lake St. Clair and the rivers do not flow. In other words, they can get typhoid fever outside of Lake St. Clair or Lake Huron.

Mr. GLENN. Here is a tabulated statement of all the cases. The statement gives the deaths per hundred thousand in your place from

1900 up to the present time. They run as follows: 47, 41, 61, 25, 56, 46, 20, and 57. In 1910 there were 74; in 1911, 48; and in 1912, 216. While some of the other towns here in the State start larger than yours, yours at the end is larger than up to the time you commenced treating the water with chlorine.

Mr. WARREN. But the year 1912 was the worst year.

Mr. POWELL. As a general proposition, is it not true, Dr. Duff, that the typhoid death-rate curve rises from Lake Huron down readily until you get to Lake Erie?

Dr. DUFF. That is possibly so.

Mr. POWELL. That seems to be the state of affairs, and that can only be accounted for by the increased pollution as the water passes long.

Dr. DUFF. Yes, sir.

Mr. POWELL. And that is true notwithstanding the fact that chlorination is resorted to by the communities below.

Dr. DUFF. I do not know whether they resort to that method or not.

Mr. POWELL. They all do, as a matter of fact.

STATEMENT OF MR. H. L. STEVENS, OF PORT HURON, MICH.

Mr. STEVENS. Gentlemen, I wish to call attention to the fact that our water supply is taken above Black River, which is a big stream and drains an immense valley. If it is necessary for us to take care of our sewage it should be necessary for every town on the Black River to do the same, in order to protect the towns down the river.

Mr. CASGRAIN. You say that the Black River drains a large extent of territory?

Mr. STEVENS. A very large extent.

Mr. CASGRAIN. Are there any towns or cities on the forks of the river?

Mr. STEVENS. Quite a number—that is, large villages or small cities.

Mr. CASGRAIN. What would be approximately the aggregate population drained by the river?

Mr. STEVENS. A statistician could give you that information better than I. Approximately, I should think, there would be 4,000 or 5,000 at least in the different towns.

Mr. CASGRAIN. There would be an aggregate of about 50,000?

Mr. STEVENS. Yes, sir.

Mr. L. A. WEIL. We have had Dr. Lohstorfer tell us about the Lincoln Avenue sewer. In 1912, previous to our epidemic, Sarnia had as severe an epidemic as we did, and of course the water in Sarnia was not affected by the Lincoln Avenue sewer.

Dr. LOHSTORFER. But their sewers emptied into the bay and they had an intake pipe in the bay.

Mr. WEIL. There is doubt as to whether or not that applies.

Mr. POWELL. The investigation of this river by the experts, which was very thorough and expensive, shows that the colon bacilli varied from 4,000 to 5,000 across a section of that river, which is about eight times more than the limit which all the experts agreed was the outside limit of what should be thrown upon a lower community to clarify.

Mr. WEIL. At the time of our epidemic here in 1912, in making tests of the water the State department thought it would be unsafe far out into the lake. Several tests made found the water to be unsafe far out in the lake. The tests were about the same as those for the water that was found unsafe at our intake pipe.

Mr. GLENN. The report from our experts shows that it is impure clear across.

Mr. WEIL. Yes; that is true. It is at least unsafe without treatment.

Mr. MAGRATH. How far does Black River extend?

Mr. WEIL. Black River empties into St. Clair River just as you go across the bridge down here. It extends up for a distance of about 60 miles.

Mr. MAGRATH. Have you any idea of its discharge in low water, the amount of its discharge?

Dr. LOHSTORFER. It is practically nothing in low water.

Mr. CADY. I believe that Mr. Summers wishes to ask a question.

Mr. SUMMERS. I wanted to ask the commission whether these experts had ever evolved a system whereby partial sterilization was possible; in other words, if the Government, through their experts, would evolve a system of purification so that the towns below us could purify their intake water by a mere addition of hypochloride of soda it would greatly simplify the problem for cities situated such as this? If the whole sewerage system of this city had to be restricted so as to carry away its drainage, which has a good deal of contamination separate from the sewage proper, it would entail an enormous expense; whereas if the present system could be utilized and a purification plant installed on the plant as it exists to-day, with purification to a partial extent when installed, and the sterilization could be completed at the intakes in the towns below us, it would simplify our proposition, and I think a good many of the citizens feel that it is up to the National Government to give some help along that line.

Mr. GLENN. We must leave that matter to the Government.

Mr. POWELL. That is just what we are trying to solve—the problem of the distribution of the burden.

Mr. WEIL. Would the commission be satisfied to report to the National Government on partial sterilization?

Mr. POWELL. Well, we have not sat in judgment on it yet.

Mr. GLENN. We want to hear what you have to say before we make any recommendation.

Mr. POWELL. We are not seeking complete sterilization.

Mr. KEEFER. It is a question of looking at the purity of water supplies. The city of St. Clair pumps a couple of million gallons a day. It would make very little difference whether they put in 10 pounds or 5 pounds of hypochloride of lime. I would like to ask the commission whether it has had any information on the oxidizing qualities of running water in a stream of this kind? Will it purify sewage? The old statement is that in 7 miles it will purify.

Mr. GLENN. It helps, but it does not purify.

Mr. POWELL. Even the tossing and the mixing that it gets when it goes over Niagara Falls, where it is oxygenated, does not kill the germs.

Mr. KEEFER. What do you find is the limit of safety in water; how many colon bacilli per cubic centimeter?

Mr. GLENN. The experts place the limit as 500 colon bacilli per 100 cubic centimeters.

Mr. KEEFER. And you found in the St. Clair River how many?

Mr. GLENN. Anywhere from 4,000 to 5,000 clear across.

Mr. KEEFER. In all tests that we have made at our intake pipe through a period of six months we have found no impure water or water which the State department considered unsafe. There were some colon bacilli reported, but not enough to consider it at all unsafe. That is 60 feet from the shore, whereas the shore water is at all times unsafe.

The CHAIRMAN. What is the depth of your water where the intake is located?

Mr. KEEFER. About 30 to 35 feet, and it is 60 feet from the shore. We have found no impurities outside of the wash along the shore which extends out about 25 feet. Outside of that you strike a very strong current. When I say no impurities, I mean impurities that were within the limit of safety. It is almost impossible to find pure water.

Mr. POWELL. They probably meant impurities that could not be remedied by chlorination.

Mr. KEEFER. It meant colon bacilli. To find water that did not contain any they had to go at least 10 miles out in the lake and out of the track of vessels. I think those are the only tests I have ever seen of water that were entirely free. It is simply a question of getting within the limits of safety.

Dr. LOHSTORFER. I just want about two minutes of your time. I shall take a position that probably will not be popular. All your witnesses here have maintained that it was not the proper thing to discharge untreated sewage into the river. I disagree with that. I think the proper thing to do and the only possible thing to do is to discharge the sewage as we are now, and educate the people not to drink water that is taken from the river or to consider that it is potable in any case without either boiling or treating it in some manner, because no matter what small percentage of sewage you remove it still will be unpotable and unfit to drink. I think that anybody who has not had typhoid fever is taking a great risk in drinking water that has not been treated. Even if sewage has been partially sterilized the water is still unpotable and unfit to drink. The experience of all the cities of the Old World shows that the people found the river water to be unpotable. The waters of the rivers in Germany are unpotable. In China for a thousand years even the less ignorant people have drunk nothing but boiled water, and I think that this whole question of trying to sterilize and make potable our river waters is Quixotic and Utopian; it can not be done. I have not had a drink of unboiled water for five years and I would not have anybody in my household do so, and we are always well. As far as our own epidemics are concerned, as I told you before, they were due to sewage leakage. Our main sewer is 75 feet below our intake. It floats to the top and surrounds our well. In the wintertime they have to open the locks and that sucks in that sewage water. That accounts for the enormous typhoid rate shown in the

report. That has been remedied, but the sewage empties into the same place.

Mr. GLENN. You think the only safe way is to boil the water?

Dr. LOHSTORFER. The only safe way is to boil the water.

Mr. GLENN. You do not mean to say, however, that treating the water would not reduce the risk?

Dr. LOHSTORFER. That reduces the risk, but you are not absolutely safe. The time will come when everybody will be vaccinated against typhoid. Probably the only diseases you can get from water are the enteric diseases. As for trying to make potable millions of gallons of water where an individual requires only a few gallons per day, I do not think the Government should take means to see that the people should have pure water any more than pure food.

Mr. GLENN. But some people will not boil the water.

Dr. LOHSTORFER. Then they will get typhoid.

Mr. GLENN. Do you think we should not take means to protect those people?

Dr. LOHSTORFER. The people might think that that sewage has been removed and the water is safe to drink, whereas it is not safe, and if you get half a dozen typhoid germs in your system you will get typhoid fever just the same. If you are going to make the water potable you must absolutely sterilize. Furthermore, everybody along the river is in the same boat. St. Clair can not justly complain of us for contaminating the water, because their people do the same thing. The same is true of Marine City in connection with Algonac.

Mr. CASGRAIN. And Sarnia does the same?

Dr. LOHSTORFER. Sarnia does the same. They always contaminated the water and always will. A thousand years from now the water will still be contaminated. That was the experience of the Old World; they can not make their water potable. The only way is for each individual to try to get pure water on his own account by boiling it.

Mr. POWELL. Your views do not differ from the views of our experts, except so far as boiling the water is concerned. If you read their conclusions you will see that they state there is no river flowing through an agricultural country from which the water should be drunk in its raw state. It should be treated to a certain extent.

Dr. LOHSTORFER. It should be boiled or treated in some other way. Of course, boiling is an absolute preventive, better than treating it.

Mr. POWELL. Of course, if you get the water to a certain temperature it kills the germs.

Dr. LOHSTORFER. I have not even taken a drink of water out of our own tap. I would not do it on account of the chlorine.

Dr. WILSON. I thoroughly agree with the remarks with respect to the imperfect sterilization of the water. I have always insisted on my household boiling the water, and I have urged my patients to do the same. As one of the commissioners said, there are some people you can not teach and you have to provide for them. The best thing to do is to create basins where sewage can be treated chemically before being turned into the main stream, as we can not go to the expense of installing wells and pumping stations to return it to the river again. It seems to me that without tremendous expense we might treat the sewage by copper solution, which is even more efficient than the chlorine, but it renders the water undrinkable if you attempt to use

it in your mains. You can treat sewage with a copper solution a great deal cheaper than you can with chloride, because the proportion necessary is very much less. If we are going to treat our sewage it should not be called raw sewage, because it is now chlorinated to a certain extent. If we are going to treat it, it could be done by the construction of pools at the present termini of the sewers and treating it with copper.

Dr. McLAUGHLIN. I think it only right to correct what seems to be a slight misunderstanding. The full and complete statement of the city engineer naturally assumes great prominence in this hearing and may affect the viewpoint of many of the persons now present. But unfortunately he is proceeding on false premises. Because of some misunderstanding of what the commission may require, or for some other reason, his whole argument was based upon the premises that it would be necessary to change the entire system of sewerage of the city of Port Huron from a combined to a separate system. That is a beautiful argument for a prohibitive expense. But it is not necessary. Any student of the question will say that the correction necessary in this locality can be effected without changing the system of sewers in Port Huron. The present combined system can be taken and a plant put in for partial sterilization for purifying the sewage. It is as well if we should keep that in mind rather than to take the engineer's viewpoint, which is based on the false premises that it will be necessary to start de capo and put in a complete system of separate sewers, which would cost the householders about \$50 each to make the connections, as we all know. It is not necessary to consider that proposition at all. There are other ways which are quite well known and are within your financial ability that are worthy of consideration, and I make that statement in order to correct what he has stated before us.

There is another point, and that is the statement made repeatedly by several gentlemen, in good faith, no doubt, that the sewage at present is partially chlorinated. Let me say that the chlorination of the water supply and its effect upon the sewage is practically negligible. The small quantity of chlorine added to the water is taken up in chemical combination and used up so that its disinfecting effect does not proceed far beyond the point where it is added to the water. It is exhausted within half an hour of its application, and it has no effect upon the fecal matter which it enters afterwards.

Dr. WILSON. In what way is it exhausted?

Dr. McLAUGHLIN. If it were not exhausted you could not drink the water.

Dr. WILSON. We get free chlorine in our taps.

Dr. McLAUGHLIN. You would have a considerable quantity of chlorine without having a taste.

Dr. WILSON. Your taste must be acute, then; but we get free chlorine in our taps.

Dr. McLAUGHLIN. Then your statement is at variance with all the other gentlemen who testified with regard to the water.

Dr. WILSON. You are depending on taste and I am depending on chemical results.

Dr. McLAUGHLIN. The chlorine is taken up. I repeat my statement that the chlorination of the water supply is practically a negligible measure of sewer purification.

Mr. SUMMERS. Will free chlorine in the water disappear in 30 minutes?

Dr. McLAUGHLIN. It depends on the amount of chlorine introduced.

Mr. SUMMERS. I am a chemist and I know what I am talking about. If you make the statement to the commission that after you have introduced hypochloride it disappears in 30 minutes you are wrong.

Dr. McLAUGHLIN. I did not make any such statement. You have got it wrong. I said the chlorination of a public water supply by the quantities used so as to not produce taste and odor in the water was negligible in its effects on sewerage purification.

Mr. SUMMERS. I think you are right there, but I understood you to say that the chlorine stayed in the water only 30 minutes.

Dr. McLAUGHLIN. It is true that in the quantities chlorine is used for disinfecting water supplies, millions of tests have shown that its effect on the purification of sewage is absolutely negligible.

Mr. SUMMERS. I criticized your statement as to the length of time the chlorine would remain in the water.

Dr. McLAUGHLIN. You agree with me that as a disinfecting agent for sewage it is negligible?

Mr. SUMMERS. I agree in that.

Mr. POWELL. If the water is not polluted to any great extent, 1 or 2 pounds per million gallons will be sufficient, and if the pollution is worse it takes a large amount of chlorination.

Dr. McLAUGHLIN. Yes.

Mr. POWELL. That means that the virtue of the chlorine is spent in the purification of the water?

Dr. McLAUGHLIN. Yes.

Mr. POWELL. And there is no effluent left to purify the sewage?

Dr. McLAUGHLIN. If you use the chlorine to any greater extent, the people would not drink the water.

THOMAS DRAPER (manufacturer, of Port Huron). When our engineer spoke of the immense cost to this city, and that our present sewer system would have to be abandoned, it seems to me that that is entirely wrong. We have our present sewers in such a position that they can be easily connected and brought to one point, at which point the sewage can be easily treated while running, or in septic tanks. The fall is such in our city that it would make this an adaptable plan.

Mr. CASGRAIN. What profession do you belong to, Mr. Draper; are you a sanitary engineer?

Mr. DRAPER. I am a manufacturer.

Mr. CASGRAIN. What experience have you in connection with this question? Your opinion seems to be valuable.

Mr. DRAPER. I may say that I have directed my study for years to general sanitary conditions, and, amongst others, the question of sewage, and I have been in a great many parts of the country where treatment of sewage takes place.

Mr. CASGRAIN. You have some experience in the matter?

Mr. DRAPER. I have seen a number of plants which have been represented to you as being successful along that line. Atlantic City, N. J., was at one time a bad typhoid city. They had a difficult

proposition in their sewerage, and their sewage had to be taken care of by a deep well, and that sewage is treated so successfully to-day that I am told by the engineer in charge that over 90 per cent of all germ matter is killed and the rest so weakened that it is not dangerous. Now, there are a great many other towns and cities that are doing the same kind of treatment. We may take it for granted, then, that the treatment of sewage can be carried on successfully. We have only one main trunk sewer, which enters under the Tenth Street Bridge, and we have another small one entering into the river, but we have nothing whatever intercepting the sewer and storm water and contamination going into the lake and river front. It seems to me one main trunk sewer intercepting along the bank is practicable.

Mr. POWELL. And would not disturb the other sewers?

Mr. DRAPER. Yes. Our present sewer at Tenth Street could be easily intercepted by another sewer, and everything collected and gathered in one. That may be done by a combination of plots at a separate point or it may be done by putting it into a septic well, and it seems to me we would have an ideal condition in this city for that. The engineer should have told us what are the levels.

Mr. POWELL. I understand that the contour of the country is practically level along the river bank.

Mr. DRAPER. At the point where our canal enters into the Black River we are 34 feet above the surface; at Gratiot Avenue Bridge we are 16 feet; at Quay Street, 5 feet; at Tenth Street Bridge, 19 feet. So that we have a fall to all these points. Speaking of this part north of the river, we have an ideal condition. When we speak of millions of dollars for new sewers at Port Huron, the figure is ridiculously high. I am not an engineer, but I would say that \$100,000 would run a sewer up along the shore as far as we would need to go.

Mr. POWELL. You say that by simple gravitation all this sewage could be brought to a common point for treatment?

Mr. DRAPER. Yes; on the north side of the river. On the south side it could be taken care of in some way. This is an engineering feat that I will be asked to explain a little later on. The sewage could be brought into a tank and handled without much expense. Instead of having one immense sewer 4 feet in diameter to cut under that river, an engineering feat that is generally successful is to bring a number of small sewers there and open them alternatively, so that they will get the full capacity. I can not say that our Port Huron sewer system is an extremely serious proposition after all. I am in hopes that the recommendations of this commission will be so beneficial that our entire lake system will be free from contamination, as well as our rivers, because it is a very easy thing to put septic tanks and incinerators aboard the steamers. The point has been made by several gentlemen that our lake water is contaminated, and I hope this commission and the Governments of the United States and Canada will not only deal with the subject of city pollution, but that they will go so far as to prevent pollution on the Great Lakes by navigation.

Mr. CASGRAIN. Assuredly.

Mr. GARDNER. That is part of the reference to us.

Mr. DRAPER. I feel confident in my own opinion that when this question is settled those rivers and lakes will be as pure as in their primeval days.

Mr. WHITMORE (city engineer). In answer to Mr. Draper's statement, I would say that our present sewers all enter the St. Clair River from the Black River at water level or about water level, so that I do not see how it would be possible to bring them to one point by an intercepting sewer and treat them and discharge them into the river again by the force of gravity without pumping. It would obviously be out of the question to pump all the storm water that will fall on 6 square miles area.

Mr. GLENN. You seem to have come to the point that you do not want any treatment of the sewage at all.

Mr. WHITMORE. In my communication I have said that to treat the sewage by screening through our present sewers would be practicable, but any other treatment of that would require a separate system.

Mr. GLENN. In your statement you quote very largely from Mr. Whipple, who has recommended the very course that we are trying to pursue.

Mr. WHITMORE. I quoted from him exactly.

Mr. GLENN. After being examined by us in New York Mr. Whipple signed that report, and he recommends the very procedure we are trying to adopt.

Mr. WHITMORE. I do not know what procedure you are trying to adopt, but if we can purify our sewage through our present sewers at a cost we can afford, that is what we want to do.

Mr. GLENN. Is Mr. Draper correct in saying that all these places around here are on a higher level?

Mr. WHITMORE. The ground level on the north and the south is, generally speaking, higher than it is here, but the sewer outlets are not.

Mr. DRAPER. Is it not a common thing to have a sewer partly submerged and partly open?

Mr. WHITMORE. It is sometimes done, but the outlet must not be higher than any other point in the sewer.

Mr. DRAPER. Are my figures right, practically speaking, as to our levels?

Mr. WHITMORE. For the ground surface, yes; but that has no bearing at all on the flow.

Mr. DRAPER. The lowest point along there I find is about 5 feet 10 above the surface of the water.

Mr. WHITMORE. That may be. Our present sewers are laid on the flattest grades. We have one 8 feet in diameter, another 6, and another 5, and we have several others that are big sewers. At certain seasons of the year, during the spring freshets, they flow full. If there is a practical way of treating that amount of sewage economically and sterilizing it, I am not familiar with it. A system of purification or sterilization that is in operation only during dry seasons, and is inefficient during a storm season, would not be of any great benefit.

Mr. MAGRATH. How long have you been in practice?

Mr. WHITMORE. I have been city engineer here for five years.

Mr. MAGRATH. A graduate of what college?

Mr. WHITMORE. No college.

Mr. POWELL. About what would the pumping of 1,000,000 gallons of water cost?

Mr. WHITMORE. Do you mean the additional pumping of 1,000,000 gallons?

Mr. POWELL. Yes.

Mr. WHITMORE. The cost of the coal would be about all—\$2 or \$3.

Mr. POWELL. How many tons of coal would be required?

Mr. WHITMORE. I can not say offhand.

Mr. POWELL. If you had to pump all the rainfall, allowing a precipitation of 5 feet, it would not be a serious matter?

Mr. WHITMORE. It is not the pumping that is the serious matter, if that were the only thing. The amount of water we would pump into our mains would not be the amount of water we would have to pump.

Mr. POWELL. I am supposing you allow your surface water to go into your general sewer system and a combined system maintained; it is not a very serious item?

Mr. WHITMORE. We also have that amount of sewage to sterilize or treat in some manner.

Mr. POWELL. Suppose we adopt sedimentation and fine screening; that does not impose on the city much additional burden?

Mr. WHITMORE. That would be absolutely impossible unless we pump it all to the one place.

Mr. POWELL. No; supposing you had your connecting sewer that makes up the whole of your system—suppose you have that a few feet lower and lift it all up and pump from there?

Mr. WHITMORE. All the sedimentation and purification tanks of that character that I have knowledge of are so arranged that they do not take storm waters which are passed to the direct outlet. They would have to be of immense size in order to take that storm water.

Mr. GARDNER. Your whole objection is based on the matter of cost?

Mr. WHITMORE. It is an economic proposition.

Mr. CADY. That closes our case, unless you have something you want to suggest.

Mr. DRAPER. I would like to have the city engineer commit himself on that statement of mine with regard to the levels, as engineer of our city. I know I am in opposition to most of the people in my opinion. This is a subject we should thrash out. I think this is the most important meeting that has ever been held in this city. I look upon it from the standpoint that health is the main thing. One of our doctors told us a little while ago that we could boil the water. I have done that for years in my own home, but I have found my little 5-year-old boy drinking water out of the tap. It is impossible to have the water boiled by everybody. How are you going to stop them drinking the water unboiled?

Mr. POWELL. Oh, yes; and you risk contagion from others.

Mr. DRAPER. If we have epidemics of typhoid, there are other ways of getting it besides through the water. I want to know from Mr. Whitmore, as a positive question, whether my plan is an impracticable one.

Mr. WHITMORE. It is impracticable to the extent that it would not be economic. It would not be possible. Most everything is

possible, but it would not be economic for us to carry the sewage to one point. It would be a great deal more convenient to treat it at several points.

Mr. GLENN. What would be the cost of that?

Mr. WHITMORE. To carry our sewage to one point would cost from \$500,000 to \$600,000. One of our large sewers at least is 2 miles below Black River, and that would mean 2 miles of sewer 5 feet in diameter, which is a large item; it would cost \$7 or \$8 or more per foot.

Mr. DRAPER. The treating plants do not cost much. You could have two treating plants—one here and one at the south end—and that would do it very nicely.

Mr. WHITMORE. Certainly; but we are talking now about carrying it all to one point. In addition to the sewer up there, we have one three-quarters of a mile down here that is 8 feet in diameter and another one nearly across the river from it which is about 5 feet. In certain times of the year they are both full.

Mr. BLACK (mayor of Port Huron). I may say to the commission on the part of the city that we are not here to antagonize anybody.

Mr. GARDNER. We understand that.

Mayor BLACK. We want to do what is right and to do it as cheaply as it possibly can be done. Our city financially is not in bad shape, and I think it is for the benefit of the city that I should say so. I admit, as Mr. Cady and the rest have done, that the river is polluted, and where that pollution comes from I do not know. If that can be remedied we would like to remedy it. As for trying to get out of anything or to get away from any responsibility, this city does not want that.

Mr. GLENN. If we should formulate a plan and send a sanitary engineer here for the purpose of investigating the conditions, I have no doubt you would cooperate with him in every way you could to come to some arrangement that would be within your power to do so.

Mr. BLACK. We certainly would; health is first.

Mr. WARREN. Is this spot here considered one of the worst on the Lakes?

Mr. GLENN. There are some pretty bad below; it is increasingly worse farther down.

Mr. WARREN. We have been led to believe, before the commission came here, that this was one of the very worst, and I am pleased it is not. I would like to correct the mayor's statement as to the city not being well off financially. I think we are pretty well off here, and I do not want that impression to get abroad.

Mr. GARDNER. We have permitted this discussion to go on informally because you gentlemen have spoken very freely, and I am glad to hear this freedom of opinion. We would like to hear what the representatives from St. Clair city have to say.

Mr. BLACK. Do I understand that you will go to Sarnia this afternoon?

Mr. GARDNER. We will divide our forces. Part of the commission will go to Sarnia and part will remain here.

Mr. WARREN. Have you investigated the conditions here personally? Have you been to the waterworks plant and the intake pipe,

and so on? If not, there are some of us here who will be glad to take you to visit it. We will furnish you with the machines.

MAYOR BLACK. I have made that proposition and I am ready at any moment when this commission is ready to go. There will be automobiles here to take the commission to see the waterworks and the

AFTER RECESS.

(The commission reconvened at 2 o'clock p. m.)

The **CHAIRMAN.** Now, gentlemen, we are ready to proceed with the hearing of the representative from St. Clair.

STATEMENT OF MR. MAX JENNINGS, MAYOR OF ST. CLAIR, MICH.

MR. JENNINGS. I do not pretend to know very much about the situation, only in a general way, as a citizen would pick up those things, but I know that at various times in the past we have had severe epidemics of typhoid fever which have been generally attributed to impure water. We have found at two different times within my knowledge that the outbreak was apparently caused by a break in our intake pipe near the shore. At times when our pipe was in good order and there were no breaks in it, the water being taken from the proper place, our typhoid fever cases have been very rare.

MR. POWELL. At that time did you chlorinate your water?

MR. JENNINGS. We did not. During the first epidemic that I remember of, which was more forcibly impressed upon my mind than any other, because it touched me in my own family, we were not chlorinating the water, but at the present time we are doing so.

The **CHAIRMAN.** How long have you been doing that, approximately?

MR. JENNINGS. I should think two or three years. Dr. Inches, who is here to answer any questions you may wish to put to him, has made a study of this matter and will be able to tell you a great deal more than I can. Everything he tells you will be backed by personal investigation and statistics to show what he says is true.

MR. POWELL. How far is the intake from the bank of the river?

MR. JENNINGS. It is near the center of the river.

DR. INCHES. It is 700 feet. I have all those statistics.

MR. POWELL. Had you any outbreaks, with the exception of these two that you have spoken of, before you began the process of chlorination?

MR. JENNINGS. I think in 1892 or 1893 there was an outbreak there. That was before I lived in the city.

MR. POWELL. That was not due to any break in the pipe, was it?

MR. JENNINGS. Dr. Inches will be able to tell you about that. I am not informed on that line.

MR. POWELL. What is the sentiment of the people down there generally? Do they complain of the pollution of the water on the part of Port Huron and Sarnia?

Mr. JENNINGS. I have heard some talk about the water being polluted above, but no serious complaint, only at the times when we are having an outbreak of the epidemic.

Mr. POWELL. Is the water disagreeable?

Mr. JENNINGS. There is no taste or smell that I have ever discovered.

STATEMENT OF DR. J. W. INCHES, OF ST. CLAIR, MICH.

Dr. INCHES. I made one or two little notes here, while listening to the gentleman from Port Huron, that I would like to take up. I want to say to the commission that I believe the city of St. Clair has suffered more in proportion to its population than any other point on this continent. I have statistics to prove that. Mayor Jennings has just said that our outbreaks were rare, except when we have had epidemics. He really does not mean that, because the only times when we have had much discussion down there have been times when we have had epidemics and a panic. For 20 years we have been the black spot. When the State health board of this State has made a typhoid-fever map, we have been the ink spot, right in the middle, and that has been true for 20 years without any exception. Once in a while the city of Wyandotte would top us a little, but our death rate in St. Clair for 15 years never went below a hundred, and it has gone up as high as 468, which is going some in typhoid fever.

The CHAIRMAN. What is your population?

Dr. INCHES. Two thousand eight hundred and fifty.

Mr. POWELL. The death rate you mention means per 100,000 population?

Dr. INCHES. Yes. Our death rate has never gone below 100 in many years until we chlorinated, and it has gone as high as 468. We have had three great epidemics; one in 1897, one in 1908, and another in 1909. The great epidemic of 1897 took about 25 people out of our town by typhoid fever. We had about 300 cases at those other times that Mayor Jennings refers to. There have been times when it has been almost a panic.

In that connection I want to bring up a very important point, and that is that the trouble from the pollution of waters here is not entirely from typhoid. Some of the gentlemen this morning laid stress on the fact that there has been no typhoid here this year; that typhoid is rare now that they are chlorinating. We have had far more damage done to our town by intestinal troubles than by typhoid fever. We have an epidemic almost every winter, and have had for 10 years, of a disease we call "winter cholera." It is an irritation of the intestines by colon bacilli. Colon bacilli are always present in the bowels of every man, so that every man in Port Huron is giving off colon bacilli every day of his life. It is not a question of whether you have had typhoid fever this year or last year, but every man, woman, and child is giving off colon bacilli, and they are giving off billions every day. I have a report here that I made to the common council of 1908, when I took the

position of health officer, and I will quote from that. I said, speaking of the time when I took office:

At that time we had just passed through an epidemic of sickness which had affected more or less at least four-fifths of the population of our city. This epidemic consisted of about 50 cases of typhoid fever and probably over 2,000 cases of intestinal disturbances, ranging in severity from very severe sickness in some cases down to only a slight indisposition and diarrhea in others. For a short time it was difficult to find many people who were not affected, and at one time the condition was such as to seriously interfere with the operation of some of our industries. Of course a very large majority were not affected seriously enough to interfere with their daily routine of life, but in all cases there was necessarily a lowering of general health, which not only increased the prevalence of all other diseases common to the winter months, but in many cases brought about a condition of impaired health lasting for months, and in some few permanent injury and ill health. The records of St. Clair show that during January, February, and March of this year there were 20 deaths in this city, of which 3 were from typhoid fever, 4 from "winter cholera," ileo-colitis, and dysentery, and 2 from other forms of intestinal inflammation, making a total of 9 deaths in three months, which were all probably directly due to the contaminated condition of the public drinking water in addition to the probability that at least some of the other deaths were caused indirectly by the fact that an infection from the water had caused a state of ill health or lack of natural resistance, which made the patients easy victims to the other diseases.

I remember that the Adams Crystal Salt Works had so many men down with what we call "winter cholera" that it looked as if the plant would have difficulty to keep going. Of the population of 2,800 at least 2,400 were affected that way, and we have more or less of that every winter. Now, as to where that comes from—

Mr. POWELL. Just before you go any further, Doctor, of course you are assuming all the time that this outbreak of cholera is due to the pollution of the water?

Dr. INCHES. I am going to take that up. The situation that I have referred to existed very often in the wintertime with us up to the time we began to chlorinate. Now, where was that from. We have carefully looked over all our epidemics, and there is no question about it; we have statistics to show that it was all from our water. We have made examinations of our water at various times. We have had samples of our water taken in our town from our taps. Those samples were styled by the State board of health as being filthy. Now, that was at a time when we found that we were taking water closer than 700 feet from the shore. Our intake pipe was broken. To show you where that pollution comes from I will refer to the work that we have done. That year the records of St. Clair for January, February, and March showed, when I made this report, that there were 20 deaths in St. Clair, of which 3 were from typhoid fever, 4 from winter cholera, and 2 from other forms of intestinal inflammation. They were probably directly due to contaminated water. I had the State board analyze 63 samples of water taken from the St. Clair River, beginning at the mouth of Pine River and going down to Marine City and down to Algonac, 30 miles from here. What I found then agreed exactly with the investigation that you gentlemen made last year. The pollution map of this city shows that if you take samples at the mouth of Black River 200 or 300 feet off the elevator at the dock all the way down you will get filthy water. There is not a single foot down here where you can get water near the shore that is not filthy.

I want to establish a point that was not established in Detroit, and that is the question as to whether the pollution crosses the river. If you will take the pollution map of this river as I established it some years ago and as you established it last year—and they agree exactly—you will find that the pollution is intense right at Sarnia, near the shore. The pollution decreases in intensity as you go down the river, and the area increases in exact inverse ratio; so there is a zone of pure water between here and Sarnia; there is a narrower zone 4 miles down and still a narrower zone down 60 miles, while at Marine City there is no zone. In other words, the impurity crosses from the American side much farther than it does from the Canadian side, because the sewage is much greater, but it is in exact proportion to the amount of sewage put in this river, and it goes across until it joins at Marine City. This fact can be established by statistics. So there is no question that the pollution goes from here over to the Canadian side, which is the point that I understood you wanted to establish.

Mr. POWELL. That is established by the investigation. I will give you one illustration of it. If you will go down to Amherstburg, for instance, you will find that the pollution indicated by the bacteriological examination was terribly intense on the American shore. It decreased crossing the boundary line, and continued to decrease until it got to what you might call the shore drift on the Canadian side. When, of course, it increased.

Dr. INCHES. Just the same as happened on this river. Dr. Price in Detroit brought up the point that the contamination that went across the boundary line was less than 500 colon bacilli per hundred cubic centimeters, and therefore it did not constitute a menace to public health. Any contaminated water is a menace, but the pollution that goes across the border is added to it.

As to the pollution coming down this river being caused by Port Huron, that map is absolute. You can follow it right down. The map of the St. Clair River shows that the great amount of pollution comes from Port Huron; that we add to it, and that Marine City adds to it.

I want to draw your attention to the fact that it is not the typhoid index of a town that indicates the amount of pollution or harm that is being done other communities. Another thing showing that it comes from our river and this city is this: Typhoid fever intestinal troubles are most intense in the autumn. It is sometimes called autumnal fever. All the rises in our typhoid-fever rate come when the sewers of this town and Black River are throwing out greatest quantity. It is just the time when they have it in inland parts of the country. Dr. McLaughlin made a report to the Surgeon General on the 1st of July, 1911, in which, speaking of this river, he stated that in the city of St. Clair during the previous 10 years 63 per cent of the typhoid fever had occurred in the flood months of Black River and 43 per cent in the one month of April. April is the black month with us. It is the month when the river in this town is throwing its volume away out into the middle of the river. You can trace the course of sewage in this town. It is easily seen out in the green water.

Mr. POWELL. Is that on account of the freshets?

Dr. INCHES. If you will notice in the summer time when there is a very little flow to the Black River the line of demarcation between this river and Big River is as prominent as it is between that desk and a piece of white paper. At this time of the year it extends out only 200 or 300 feet.

Last year I gathered samples for your commission, at the request of Dr. McLaughlin, and as we worked we would cross the border every day of Black River and the St. Clair River water, which is the same as going from outdoors to indoors. It does not take a bacteriologic examination to see the pollution. You can see it going down the river and enveloping everybody. If you will look at the condition that exists in May or March you will see a difference. Instead of Black River throwing out a little amount of water, as it does now, it is a roaring stream. It rushes out almost to the middle of the river, and it is then when we get our punishment every year, when the snow is melting here. It is in the two months of the year when the sewers of this town are giving off their largest discharge that we get 63 per cent of our troubles.

If there are any questions that you would like to ask as establishing the pollution coming from here I would be glad to answer them.

Mr. POWELL. We are pretty thoroughly a unit from the figures that the pollution does go across and mix up.

Let me explain this proposition of 500 *B. coli* per 100 cubic centimeters. Under the treaty and under the reference to us we are to see if any pollution crosses the line which endangers the life of citizens on the other side. I am voicing the consensus of opinion of the commission, I think, when I say that we saw that there would be an enormous tax imposed upon the different communities if they were forced to purify the water absolutely. We saw also that it would be useless to purify the water absolutely, because pure water would be going into a large stream that was contaminated or polluted to a certain extent from bank to bank, so that would be asking a great deal more than was necessary. Then came up the question as to what burden should be imposed on the lower riparian community that suffered from the upper and what burden should be imposed upon the offender. In the investigation it came out that no purification appliances below should be taxed with water that contained in excess of 500 colon bacilli to 100 cubic centimeters. Do you understand it?

Dr. INCHES. I understood that before. I have been following the investigation right through.

Mr. POWELL. You have traveled; Dr. Inches?

Dr. INCHES. Yes, sir.

Mr. POWELL. Have you ever seen the phenomenon of two rivers, one muddy and flowing into a pure stream, and how they will run parallel with a well-defined mark of delimitation of the two waters?

Dr. INCHES. Yes; I can see it here in summer.

Mr. POWELL. Have you ever seen the Frazier and the Thames?

Dr. INCHES. No.

Mr. POWELL. The one is a muddy river and the other is pure. You will see those two running together with the green of the Thames and the murky, chalky Frazier for a couple of miles, but after a time the line is obliterated. If you will take the pure green

water that comes down the St. Lawrence and the turbid waters of the Ottawa, you will see that they unite before they get to Lachine.

Dr. INCHES. Mr. Commissioner, you are giving it just as it is, but you must let me add that at no other place in the world do they mix as quickly as they do here.

Mr. POWELL. Except at Niagara.

Dr. INCHES. I judge that you gentlemen are all familiar with the amount of tonnage that we have moving up and down this river. Every one of those steamers is a churn. The J. W. Wescott Marine Reporting Co. in Detroit, who have very accurate figures on the subject, tell me that last year there were just 21,000 freight steamers passed through this river—21,000 big screws, 12 feet in diameter, just churning up this river; good-by to your line right away.

Mr. POWELL. We have sworn testimony on that point.

Dr. INCHES. That is exclusive of passenger boats. Those figures are simply for freight boats carrying freight through the Detroit River and through this river.

Mr. POWELL. The following you may regard as authoritative and as given under oath: On an average there is a boat or vessel of 3,500 tons passing up or down this Detroit River every 13½ minutes in seven months of the year.

Dr. INCHES. How long do you suppose our line of demarkation is going to last with this churning going on? Not long. Some of those boats go close inshore. Now, what should be the remedy? There is no doubt of the condition. In our great epidemic of 1897 it was an interesting thing to note that our great epidemic followed an epidemic in Sarnia, and the ice in the river was crushing backward and forward at that time. Whether it came from Sarnia or not I am not prepared to say. Unfortunately, in your investigation at Detroit and here this morning you seem to get a good deal of opinion. Alderman Vernor said very seriously that his opinion was that no pollution could cross this river. That was just as valuable as if he said he did not think it was going to snow next Christmas.

I want to say to you on behalf of St. Clair that if there is any place in America where no form of screening will be adequate it is right here. You could take out all of the solid matter in Port Huron and you could not protect us. Why? Because the current in this river, and this has been demonstrated, is so strong that a man defecating in his bathroom in this town at 8 o'clock in the morning can serve a part of that up to us on our dinner table in the afternoon. You can follow the course of sewage, and in four hours that is into our intake pipe. Now, it doesn't do any good to screen out the solid matter in that water. It is true that colon bacilli will not live a great length of time in cold water, but they live longer than that. Nothing will do us any good on this river but chemical sterilization. The people here say that is going to cost them too much. We were told this morning that they would have to reconstruct the whole sewage plant. That was contradicted by Mr. Draper, and I think very cleverly, too. But it does not matter what it costs. Sterilization should be resorted to in this town.

You say we can chlorinate. Well, chlorination we have been adopting for two years, and it is a very good thing, but it is very unreliable. A year ago last spring I came back from Florida. I had been instrumental in getting the chlorination plant installed.

When I came back I said to the superintendent, "How is your chlorination plant working?" He winked at me. He was an old appointee and knew that his duty was not to give anything away. I went to one of the leading men and asked the question. He looked into the matter and reported to me that while we had been chlorinating all winter, and while the people of St. Clair had thought they were protected and the families had stopped boiling their water because they thought the city was protecting them, the superintendent of our waterworks and the engineer had gotten together one day and concluded that the chlorination was a darned nuisance, and they had stopped three weeks before. The council, the waterworks board, and the people of St. Clair were sleeping nicely, thinking they were protected, and there had not been a thing done in three weeks.

Mr. POWELL. Do you think we should take that into account?

Dr. INCHES. You should take into account the unreliability of chlorination.

Mr. POWELL. That is the unreliability of the men who had it in charge.

Dr. INCHES. That is one of the points, Mr. Powell—the danger where you are dependent upon employees. When we took samples in this city for your commission last year we had a laboratory near the Harrington Hotel, and while we were examining the samples every day we drew a sample from the waterworks of this city. The people thought they were protected then. There was no interruption at that time in the chlorination plant. Everybody thought it was running all right, and on 17 days out of 27 we found colon bacilli in 1 cubic centimeter of water.

Mr. POWELL. Is that given in our report?

Dr. INCHES. Yes, sir; that is in your report. That shows what chlorination is in its practical working. I went to Commissioner Dixon and told him of the matter, and he said he had investigated it and found that it had not been working right. So much for sterilization. Now, the remedy, as I say, is sterilization up here. It is the only remedy that will do us any good.

Mr. POWELL. How do you propose to bring that about?

Dr. INCHES. In the manner that was spoken of here this morning—bringing the sewage to certain gathering basins and sterilizing it with lime. The city of Hamilton sterilizes all its sewage on Lake Erie. It did so some years ago. Now, the cost they speak of as being prohibitive. I do not think the cost should be taken into consideration. They speak of the assessed valuation of the town and the amount that they are allowed to raise, but I do not think it will go beyond that. If it does, they should have special legislation. Special legislation is gotten very easily in this State. Some years ago, when I was mayor of St. Clair, I appointed an assessor who tried to put all of the personal property on the tax roll, and it was so unpopular—

Mr. CADY (interrupting). Did you make the statement, Dr. Inches, that we could get more money by special legislation?

Dr. INCHES. I should think you could.

Mr. CADY. The statutes of this State prohibit any special legislation.

Dr. INCHES. Since when?

Mr. CADY. Since 1909.

Dr. INCHEs. I beg your pardon; I take it all back. It was easy some years ago to get special legislation.

Mr. POWELL. Is that a constitutional amendment?

Mr. CADY. It is a constitutional provision. You can not pass any local legislation in this State.

Dr. INCHEs. I take it all back. I thought it was the same as it was several years ago. Anyway, sterilization is the only thing, and I do not think it would go beyond bonding limits. Nothing else will do us any good at all. They say, "Put it on us; we should bear part of it." One gentleman said, "Do you not think you ought to purify it when you take it out of the river?" A filter for the little town of St. Clair will cost us \$40,000 besides the running expense, which is a great deal more than any system of purification will cost in this town in proportion to their population and ours. You can purify the sewage and sterilize it in this town for one-quarter of the amount that would be required by us to build a filter and purify our water. So that sterilization is the only thing, and it ought to be done here.

I can not impress upon you any stronger how we have suffered down this river. Dr. Degurse is here from Marine City. He said he was going to tell you that they had only had one epidemic in Marine City in 18 years. I told him that I knew better than that. He said, "Well, they only had one, but it lasted for 18 years."

Mayor Jennings failed to tell you, but I know he intended to tell you, that we are willing to do whatever we have to do in the way of treating our sewage in Marine City.

Mr. POWELL. I would like to have your opinion on this question. Speaking about the outbreak of typhoid epidemics, does or does not that depend upon the bacilli of typhoid fever being in the water?

Dr. INCHEs. Yes.

Mr. POWELL. That would depend again upon the existence of typhoid fever in some riparian community above?

Dr. INCHEs. Certainly.

Mr. POWELL. So that the conditions which would be fatal in case there were typhoidal bacilli coming into the water might go along for years and years without any harm, should there not happen to be an outbreak above?

Dr. INCHEs. Yes. I would like to emphasize that. We have had very little typhoid this year in St. Clair. Whether it is due to chlorination or to the fact that they have had none in Port Huron I do not know. You can follow it down the river just like you can follow a steamboat. You can follow it along the bank, and the people who have taken their water out of the river have seen it going right down.

Mr. POWELL. That is, the pollution, of course?

Dr. INCHEs. Yes, sir. You will hear people say that a town should be made to sterilize the injections from typhoid-fever patients. Such patients give off typhoid-fever germs and other germs sometimes two months after they get well. So that if they have 3 or 4 cases of typhoid fever in the winter, or 10 cases, those cases will be giving off typhoid germs for months after the physician has stopped sterilizing.

Mr. POWELL. If that is true, why is it in the most modern hospitals throughout the world—hospitals conducted on the most scien-

ific principles—the typhoid-fever patient is placed in a noncontagious ward with other patients suffering from other diseases?

Dr. INCHES. They give off the germs through their bowel injections, and those are disinfected. You can not catch typhoid fever in any other way.

Mr. POWELL. I understood you to say that the diseased germs emanated from the body.

Dr. INCHES. They emanate from the body by one source—by the rectum.

Mr. POWELL. What did you mean by typhoid-fever germs being given off by convalescents?

Dr. INCHES. Through his bowels entirely. Another thing I would like to put into this record is the fact that I think you ought to give some consideration to the people along this river who are not accessible to waterworks. We have a river 30 miles long. On the lower 15 miles there is one mass of summer cottages. In 15 years from now there will not be a foot that is not occupied by summer visitors. A great majority of those people are not accessible to the waterworks. They take their water by sticking a galvanized iron pipe out into the river. I have seen plenty of young fellows die on this river just as they were beginning manhood who got typhoid fever while swimming. You can not stop that, no matter what you do. Most of those boys will take a drink of water right off the surface. There ought to be as much protection as is reasonably possible.

Mr. POWELL. Whatever weight there may be in your contention would be emphasized by this consideration, that the children at these summer residences, as a general thing, are not swimmers in the bay, but they play in the lateral wash, where the pollution hugs the shore, and they get it in its worst condition.

Dr. INCHES. Yes; that is true. There ought to be some consideration given to that population. It is enormous and it is growing all the time. This river will rival the Hudson in its popularity. In 20 years from now this river will be a great mass of cottages on both sides, and four-fifths of those cottages will not be accessible to waterworks. No matter what is done in the way of purification at the intake will do them any good whatever. If there is any possible way that this city could sterilize absolutely, you would keep it down. We had it emphasized that the water coming into the intake here is all right. That is all we like. All we can ask of Port Huron is that they deliver us water as good as they get it. Some statement was made that the water of the lake was bad. Our records do not show that. There are little spots here and there, due to steamers. At Keewatin Beach I took 50 samples, and only 1 was contaminated. Down lower, at the life-saving station, we took another range, and only 3 out of 50 were contaminated. So, there is good water not far from here. There is good water right here if they do not contaminate it. We only ask that we have the privilege of using the good water that God has given to this country; and we are entitled to get just as good water as flows in from the lake here. If Port Huron damages our water, they should repair the damage if it is possible.

So far as concerns the load idea established by Mr. Fuller and others of 500 *B. coli* per 100 cubic centimeters, unless it is purified you can see that this is going to spread disease all along the line.

Mr. POWELL. Do not let us get confused on that. That means this, that no water more polluted than that can be thoroughly treated by an ordinary plant. The plant would be overloaded if you increased it.

Dr. INCHES. The opinion of the experts of the country is that no water that carries more than 500 B. coli per 100 cubic centimeters can be purified by existing methods and made good to drink. I will say to you that in April and in March and in February no system of purification that can be devised in this town short of sterilization can give us water that does not have 10 or 20 times that much. The samples taken were taken on this river at the negative point in the year. I begged Dr. McLaughlin to hurry up and get going, because this river was getting better every month.

Dr. McLAUGHLIN. It was not my fault.

Mr. POWELL. I can give you an authoritative statement of fact on that point. We wanted to get, if possible, an investigation when the pollution was at its greatest height, in the latter part of March and April. Unfortunately, we could not get to work until May.

Dr. INCHES. We got it here in July and August, the most negative months in the year. I will say now that if you will take samples of water in this river at exactly the same points that they were taken last year in August, and take them in February, March, or April, they will show ten times the contamination.

I said that the water is good at the intake pipe here. It is good at this time of the year, but they have devised a method of purifying this river. It used to be so stagnant that it stunk, but the stinking part was something that hurt nobody's health. They drain now in from the river above, and when the river rises in the freshet time they have a river with two mouths. I do not know what happens to their water then. They really devised a method here of polluting their own water for several months of the year. I understand they are going to put in a gate. When Dr. McLaughlin was here last year he said they will have a sand gate, and they did. If they let their sewage go into that river and lie there dead, the colon bacilli will die in a very short time. They have now devised a method of having it smell and look a little nicer so we will get it fresh at any time.

Mr. CADY. What method are you going to adopt of sterilizing the sewage that comes from the city of Chicago and all these villages along Black River?

Dr. INCHES. I do not know. That is a question for the commission. I would like to have somebody appointed to find out just what the condition of the water is at the city limits in that river. I do not think those towns contaminate it very much. It is going a long way and very slowly.

Mr. CADY. You know in the spring of the year, when we have freshets, there are great rapids there. You would have to sterilize the Black River in addition to the sewage of Port Huron.

Dr. INCHES. No. I think if you will sterilize all your sewage, all the pollution that comes down that river diluted by the amount of water will not amount to anything.

Mr. CADY. You see, the water that we get into our intake pipe is clear and pure.

Dr. INCHES. I do not know anything about it except what I have heard here this morning.

Mr. CADY. Did not I hear you say that the water that we took in our intake pipe was pure?

Dr. INCHES. I said it was so stated here this morning.

Mr. CADY. I thought you made the statement that it was pure.

Dr. INCHES. No.

Mr. CADY. You did not make that statement?

Dr. INCHES. No, sir. I simply said that the man who spoke this morning made that statement.

Mr. CADY. I think the record will show that you made the statement that it was pure.

Dr. INCHES. No; because I know that it is not.

Mr. CADY. Did you not say that all you wanted was the same kind of pure water that we got at our intake pipe?

Dr. INCHES. Yes, sir.

Mr. CADY. Then, why would it not be cheaper for the city of St. Clair to take water from the same place that we take it?

Dr. INCHES. If you will pay for the pipe we will take it from there.

Mr. CADY. Why can not the city of St. Clair do it?

Dr. INCHES. That would break us. We have to draw our water through a 12-inch pipe.

Mr. CADY. How much would it cost?

Dr. INCHES. I do not think we could lay the pipe for \$75,000. I will ask Mr. Draper about it.

Mr. DRAPER. For the actual cost of the pipe we could lay it.

Dr. INCHES. It is 15 miles from where you get your water to where we get ours. That would mean about \$80,000 worth of iron pipe, and that expenditure would be just about one-half the cost.

Mr. CADY. It is cheaper for us to do it than to adopt the plan you suggest.

Dr. INCHES. No; you can sterilize your sewage here much cheaper. I have thought of the plan of getting water from here. It is prohibitive.

Mr. CADY. Is or is not our water pure at the intake pipe?

Dr. INCHES. I do not know; I have never examined it.

Mr. CADY. What is your judgment of it?

Dr. INCHES. I think it is good drinking water every day in the year. If the allegation of Dr. Lohstorfer and some others is true that you have a sewer washing into it it is not.

Mr. CADY. Have you not taken some samples from that water?

Dr. INCHES. No; I never did. I took samples from just above Black River. Our samples taken there were good.

Mr. CADY. But you did not take any near the intake pipe?

Dr. INCHES. No; nothing more than a hundred feet above the Black River.

Mr. CADY. But you did go into the lake?

Dr. INCHES. Yes; that was for the Government last year. This matter is one that will stand a good deal of discussion, and I would like very much to answer any questions. All I wish to bring out is the truth. The samples taken above Black River by us consisted of 50 samples taken at the life-saving station, at 10 points from here to Canada evenly divided. Of those samples there were 6 contaminated slightly. We took 100 samples above Black River and every one was

fit for any city in the world. Those samples showed good drinking water.

The CHAIRMAN. Were those samples taken below the intake in this city?

Dr. INCHES. No; they were taken a long distance out. Their intake is about a mile from here. The samples that I am speaking of as being pure were taken 7 miles from here.

The CHAIRMAN. Would that be out in the lake?

Dr. INCHES. That would be out in the lake; yes, sir.

Mr. CADY. Have you any sewage north of your intake pipe flowing into the river?

Dr. INCHES. Nothing to amount to anything. A little private sewer, I think, runs in, but nine-tenths of our sewage goes in below the intake pipe. Our intake is 700 feet from our docks, and any sewage that goes in above would not get one-quarter of the way. There is no sewage in our town that under any physical condition could get half way out into the intake.

Mr. CADY. Do you pump into a well?

Dr. INCHES. No; we did, but we do not now.

Mr. HILL. During the time that the epidemic was so great down at St. Clair, did not your intake pipe break in the center?

Dr. INCHES. Yes, sir.

Mr. HILL. And two-tenths of this sewage that went in above that pipe would contaminate that water more?

Dr. INCHES. In one of the epidemics I imagine that was possible, and I claim it was true. I claimed in our great epidemic of 1897 that part of it was due to our own sewage. In the epidemic of 1908 the break was found away out in the river beyond where we could contaminate the water, but in both epidemics we were not getting water 700 feet out in the river; it was less than 100 feet. But that does not remove the fact that when our intake pipe has been repaired and kept in shape our typhoid fever has been the worst in Michigan for 15 years.

Mr. STEVENS. You state that while our chlorination plant has been in good order you have not had any typhoid fever?

Dr. INCHES. No; I did not say that.

Mr. STEVENS. You made a statement somewhat of that character.

Dr. INCHES. I said it had been stated here this morning that you had not had much and at those times we had not had much.

Mr. STEVENS. In other words, when our plant is in good shape as long as we have not had any typhoid you have not had any?

Dr. INCHES. Not much.

Mr. STEVENS. Do you not think that before trying any sterilization plan this chlorination plant should be tested out? Do you not think that that plan should be tested out before going to any great expense? In other words, your only objection to chlorination, as I understand it, is the fact that somebody might not look after it when it needed looking after. Is not that also true of your sterilization plant?

Dr. INCHES. No.

Mr. STEVENS. Do you not think it would be possible to have a chlorination plant established of a character that would connect right up with the machinery so that no water could be pumped unless a certain amount of chlorine were put in, and thus make it beyond human foresight?

Dr. INCHES. Yes; I think that would be possible.

Mr. STEVENS. Do you not think it would be better before going to any large expense in the way of changing sewers to try out the chlorination proposition?

Dr. INCHES. No; I have just said that typhoid fever has done us less harm than other intestinal troubles. At one time nearly our whole town was sick. No amount of chlorination could have affected that in any way.

Mr. STEVENS. It has been stated that within 20 years our river will be lined with summer cottages. Is there going to be any way whereby those summer visitors will not sewer into the river?

Dr. INCHES. They will not if they are not allowed to. There are thousands of resorts in this country on the banks of beautiful lakes that have their pits that they clean out once a year. There are places all over this country where no man would be allowed to sewer right into the water where his children are playing. I would like to emphasize the fact that chlorination of the water here to any extent will not have any effect upon the sewage that goes out of this town, except to keep down typhoid fever in the town. I do not think there is much typhoid fever comes down from your lakes. I think it is a good thing to chlorinate for the amount of pollution that you do have. Most of your cases of typhoid come in here by transportation. No city in the world is without typhoid. It comes from various sources. I think that most of your typhoid here is brought in and chlorination of the water is not going to help us at all. It is your sewage that does the harm and is doing the harm every day in the year. Dr. Wilson said this morning that chlorination, if carried on strong enough, helped clear up the sewage. The Doctor did not stop to think, I am sure, because the amount of hypochloride that is put in the water now is the amount that is estimated by experts to be enough to oxidize the amount of organic matter that is in the water. If you put in 20 times as much as you do in your water here it still would be far less than enough to eat up the organic matter in sewage. The hypochloride of lime that is put into your waterworks would not last that long [snapping his fingers] if put into the sewage.

Mr. STEVENS. You said that you could not get typhoid fever unless you had typhoid germs.

Dr. INCHES. Certainly not; and you will not give us any typhoid if you haven't any typhoid, but you will give us colon bacilli from your bowels every day. Every man in this room is giving off millions and billions of colon bacilli every day.

Mr. STEVENS. What proportion of the population of St. Clair is taking the water from the waterworks?

Dr. INCHES. Practically all. I asked the superintendent this morning as to the number of wells in our town and he said he only knew of four or five. We are one of the biggest users of water per capita in the country. We are pumping now about three quarters of a million gallons per day.

Mr. WEIL. You are laboring under somewhat of a misapprehension with regard to this Lincoln Avenue sewer. We have always claimed that the water going around this well would contaminate the water of the well; but the intake pipe is out in the stream quite

a ways, so that that water does not reach there. At least, they have never been able to show that the sewage from the Lincoln Avenue sewer reaches the intake. It has been repeatedly reported that the water at the intake is unsafe. Those were reports from the State of Michigan. Dr. McLaughlin, have you any such reports?

Dr. McLAUGHLIN. That is quite true. The water at the intake is repeatedly reported as unsafe.

Mr. WEIL. I am glad that you bear me out in that statement, Dr. McLaughlin. We have had that put up to us so often.

Dr. McLAUGHLIN. It might be expressed in this way: You have probably as good raw water as exists anywhere to serve to a purification plant. It is an excellent raw water, but it is not a safe water without purification. It is very similar to the Detroit intake, which is placed in an excellent position, probably the best position between Port Huron and Lake Erie, but it is not a safe water to drink without purification, although it makes an excellent water for purification.

Mr. WEIL. If St. Clair took its water from the same place that Port Huron does, St. Clair would still have to chlorinate its water?

Dr. INCHES. Just as you do, but, as the commission has explained, chlorinating a very small load is different from chlorinating a big load. You can chlorinate raw water like that with 3 pounds to 1,000,000 gallons. You can not chlorinate the water we get from here six months in the year with 10 pounds and do it right. Do you not see the difference?

Mr. WEIL. Do not misunderstand the attitude of the city. We want to see pure water.

Dr. INCHES. I am rather surprised to find that the city of Port Huron does not know any more about the impurity of its water than it does. The city should get some man to handle the pollution matter.

Mr. HILL. We take samples of the water every month.

Dr. INCHES. Why do you not take samples from the upper end of the river and know what comes down from your beaches?

Mr. HILL. There are very few beaches that empty their water into the lake.

Dr. INCHES. I am glad to know that. I think I can tell you just the amount of contamination that there is in the river within 3 miles of St. Clair. We have had 63 samples taken by me and a hundred or so taken for the commission last year with probably another hundred taken by various cities and towns. If there is any other question I would be glad to answer it.

Mr. POWELL. I might be inclined to agree with the greater part of what you say, but coming down to the purification of the sewage you will admit this: That apart from the city altogether and its deposit of sewage into the river, with natural causes such as the surface waters from the hills and the water coming down the streams connected with this river, that would have the effect upon the water of the river of making it a nonpotable water in the raw state.

Dr. INCHES. Not to the extent of making anybody sick. I will refer that to Dr. McLaughlin.

Mr. POWELL. I think the Doctor will be against you there.

Dr. McLAUGHLIN. I could not agree with you there. I do not think any surface waterway can furnish, 365 days in the year, a safe water without purification.

Dr. INCHES. I think you are right. That is true in the main.

Mr. POWELL. Now, assuming that, let us go further. If it is necessary for the riparian community lower downstream to have a purification plant at all, what is the object of having the superior communities purify theirs to a state of absolute perfection when it is going to be contaminated by the surrounding water when it gets into the stream?

Dr. INCHES. Simply because if they do not sterilize it chemically they can not purify it so that we can purify it with any existing means safely.

Mr. POWELL. You are speaking about purifying it chemically. Where is that done?

Dr. INCHES. At Hamilton, Ontario.

Mr. POWELL. It is very exceptional, is it not?

Dr. INCHES. Hamilton, Ontario, treats all its sewage in big vats, and has been doing so for many years.

Mr. POWELL. It is not recognized as an up-to-date process, is it?

Dr. INCHES. It is away ahead of date for all the rest of us.

Mr. POWELL. Are not the two almost universal means of clarifying and purifying water the following: Sand filtration, the old English settling bed, or the rapid or mechanical filtration? Now, if it is a turbid water and they want to clarify it as well as purify it bacteriologically they get some coagulant which they infuse into the water and cause the solid matter to gather together and settle, just like an eggshell will cause coffee grounds in a pot to settle. If these processes are not sufficient, is it not a common thing to give it a second dose, to put it through another filtration?

Dr. INCHES. Yes.

Mr. POWELL. And then, strange to say, unless the information that I have obtained from books and from the reports of the greatest experts of the continent is entirely unreliable, the chlorination should be resorted to purely and simply as a factor of safety.

Dr. INCHES. Yes; that is very true.

If the city of Port Huron will adopt any method that will bring the load of pollution down to 5 colon bacilli per cubic centimeter or 500 colon bacilli per 100 cubic centimeter, that is all we ask.

Mr. POWELL. Your community will then be satisfied?

Dr. INCHES. Absolutely satisfied; and you can not do it except in the way I have stated. That will satisfy St. Clair and all the rest of the communities on the river. It was said here this morning by one of the gentlemen who referred to the cost that schools and other matters had to be taken into consideration. All the blessings that come to us as human beings do not amount to anything alongside of pure air and pure water, and those are all we want.

The CHAIRMAN. Is there anyone else from St. Clair who wishes to be heard?

STATEMENT OF DR. W. H. SMITH, OF ST. CLAIR, MICH.

Dr. SMITH. I did not come here with the intention of saying anything, but came rather to listen. I am, however, greatly interested in this question, because the question of pure water is simply one of health. I think I ought to perhaps call attention to a slip of the

tongue that my brother, Dr. Inches, has made. He referred to getting his samples from the foot of Pine River and just above the foot of Pine River down below. I think he meant Black River. Is not that true, Dr. Inches?

Dr. INCHES. Yes; I did.

Dr. SMITH. Another thing I would like to call attention to is that he referred to our epidemic of 1897. I think he was wrong about that. I am sure the epidemic was in 1898.

Dr. INCHES. I accept the correction. It was in April, 1898. I think you are right.

Dr. SMITH. It was in the winter of 1897 and continued in 1898. Some years ago I was health officer of the city of St. Clair, and while occupying that position I went to work and took the death statistics of our city from the year 1897 down to 1912, added them up and divided them, and estimated them on the basis of 100,000 population, so as to get our average death rate from typhoid. I found it ran 106 per 100,000, an awful record for any town to make. I also did the same thing with respect to Marine City. They are down below and they get the benefit of our sewage. Their average was 116 for the same period. Theirs was a worse record than ours. They have not had these explosive outbreaks that we have had, but they have had the same trouble right along.

Considerable reference has been made to what the Germans do. I have been talking with Germans, and they tell me that in Germany they will not allow a particle of sewage of any kind to go into a lake or stream unless it is previously treated.

Mr. POWELL. That term "unless previously treated" is such an ambiguous and loose one, Doctor, that is it absolutely meaningless. The whole thing is the degree of purification.

Dr. SMITH. I think the Germans when they do a thing do it systematically and well. When a German city gets a death rate of 4 per 100,000 they think it is something that needs looking after, and they begin to see what is wrong with their water. I think Dr. McLaughlin will agree with me on that. Now, here we get death rates in this city of 106 on an average.

Reference has been made to the fact that our pipe was broken. Yes; there were two occasions when we had epidemics at a time when our pipe was broken, but they happened in the spring of the year, when we got Port Huron sewage in the floods. Did our own sewage get into it? It is possible that it might have come from our sewage, but I am inclined to think it came from Port Huron in those cases. If it came from our own sewage it would come at the time our pipe was broken, which was probably done by some boat the summer before. But, as a matter of fact, we did not get it until the following spring, at the time we got the flushing out of Black River. So it looks to me as if every case of typhoid came from up above. I think it is true that we are trying to use the same stream for a well and a water-closet. The Creator did not make us so we could make a success of it, and we are paying the penalty of disease and death. I think Port Huron ought to be made to take care of its sewage in a sanitary way, and I think you should do the same thing with St. Clair. I think we should not put our sewage into the drinking water. It is an outrage on Algonac for Marine City to put its sewage

into the drinking water. I think you should make all of them deal with their sewage in a sanitary manner.

Mr. CADY. Have all your epidemics in St. Clair been in the spring of the year?

Dr. SMITH. Yes, sir.

Mr. CADY. And that is the time of the heavy freshets in Black River?

Dr. SMITH. Yes, sir.

Mr. CADY. When the sewage is coming for miles north of here as well as from Port Huron?

Dr. SMITH. Yes, sir. I am glad Mr. Cady brought that up. This river runs up here some 60 miles or so. It is used all the way along for pollution, being polluted everywhere. The same thing that applies to what Port Huron does here applies all along the stream; and the whole thing, in my opinion, is wrong. Dr. Inches referred this morning to something that may have had something to do with Port Huron's typhoid. For instance, up here they have cut across to Black River, and when the freshets occur there are two mouths, one running out into Lake Huron above their waterworks and the other down below. It is true that that opening may be above every sewer of this city, but it is not above the sewers of the town below.

Mr. CADY. Black River, Doctor, is practically a sewer for the Thumb district, is it not?

Dr. SMITH. Yes, sir.

Mr. POWELL. Are you sufficiently familiar with the locality to inform us whether there is any special reason for the murkiness of the river that flows through the city here? Is that a result of the general gathering of the pollution above?

Dr. SMITH. I am not familiar enough to know what it is due to, but I understand that some parts of it run through a low, marshy section and it takes its color from the soil. Mr. Cady has probably been over the district more than I and is better informed on that subject.

Dr. DUFF. We had no disturbance of this kind to speak of in Black River previous to the building of the wood-fiber works here. After the building of those works it became very black, owing to the action of sulphuric acid gas. You will find above the fiber works that the natural color of the water exists as it was for 45 years. That is the reason our river is in its present condition.

Mr. KEEFER. Dr. Duff, I have heard that statement made a good many times. I have examined the banks of Black River for several miles, and I think you will find little black streams oozing from the banks close inshore. Whether that is oil or whether it is something else, I do not know; but if you will walk along carefully through the reaches of the river above the fiber works, you will see black stuff coming from the earth and flowing into that river. That river was black before there was any industry or any city here.

Mr. DRAPER. I have watched that condition very closely along Black River, and I fail to see any difference in its color above the canal from what it is down the river. As a matter of fact, they claim that the St. Clair epidemics are from the freshets in the spring. Often in the summer I go out in the hayfields which are surrounded by Black River. Many a time I have thrown a chip out on the sur-

face of that river and have found that it remained there all day. I doubt if there is any current in Black River above the canal. If there is much water going through there, the water almost forms a wall; so I think there can be no contamination whatever from up Black River unless it may be during the freshets.

Mr. POWELL. That is the period that they complain of—the freshet time.

The CHAIRMAN. I do not just get your meaning, Mr. Draper, as to the canal. Where is the canal?

Mr. DRAPER. This is the drainage canal that was put through from Lake Huron. In other words, this river runs west and then turns north.

The CHAIRMAN. Are there any other gentlemen from St. Clair who wish to be heard?

Mr. JENNINGS. I think that is all, Mr. Chairman. I wish to say to the commissioners that we are willing, in St. Clair, and anxious to do all we can to cooperate with the commission in getting a better supply of water.

The CHAIRMAN. We are obliged to you for your attendance and interest in this matter. Is there anyone present from Marine City who wishes to be heard?

Mr. G. W. BECKER, mayor of Marine City. As I have made no report and have no data on this proposition, Mr. Chairman, I shall have to refer you to our city health officer, Dr. De Gurse. I will state that we are willing to cooperate with you gentlemen in bettering the conditions of Marine City.

STATEMENT OF DR. THOMAS E. DE GURSE, HEALTH OFFICER OF MARINE CITY, MICH.

Dr. DE GURSE. Mr. Chairman, this subject seems to have been thrashed out pretty thoroughly from one end of the river to the other, and all the germs have been found, I think. A peculiar situation in our city is that we have typhoid fever almost constantly. With the exception of this last year, I do not suppose that for the 19 years that I have been practicing medicine in the city of Marine City we have been one month entirely free from typhoid fever. We have had some high mortalities in some epidemics. I say epidemics; it is worse following freshets. We have our worst siege of typhoid in February, March, and April, and in the fall of the year if we have heavy rains.

We chlorinate the water, and have been doing so for the last year. I think we have had only 6 cases of typhoid fever during that year, where theretofore we have had an average of 150 cases every year.

I practice 4 miles south of Marine City and the river frontage is very thickly populated, especially in the summer time, and I have never seen a case of typhoid fever south of Marine City during the summer time. Nor have I treated a case of typhoid fever, with the exception of two cases, in the 19 years that occurred among the inhabitants of the river frontage; but, nevertheless, in our own city we were never free from it until this year. We are willing to do anything that the commission would suggest or recommend in order to clean up our own town. Whether it comes from Port

Huron or whether it comes from St. Clair, I remember that the highest mortality that we had occurred in the spring of 1898. An epidemic broke out in St. Clair along in February and ours broke out in April, and we had a very high mortality. I think the mortality was something like 10 per cent. As a rule our forms of typhoid are of a mild type. We have from four to five weeks' duration of it. We are open for suggestions.

The CHAIRMAN. What is the population of your city?

Dr. DE GURSE. Three thousand seven hundred. All our sewers empty into the St. Clair River.

Mr. POWELL. Are you incorporated?

Dr. DE GURSE. Yes, sir.

Mr. POWELL. Do you publish annual financial statements?

Dr. DE GURSE. Yes, sir.

Mr. POWELL. Will you see that the commission is supplied with them?

Dr. DE GURSE. Yes, sir; I will. I will have the city attorney send you copies.

The CHAIRMAN. What is the amount of water that your people consume, approximately?

Dr. DE GURSE. I am not familiar with the amount, Mr. Chairman. I would have to call upon the mayor for that information.

Mr. BECKER. I am not in a position to answer the question.

Dr. DE GURSE. I do not believe there is any data in the city.

Mr. POWELL. You heard what Dr. Inches said about his community being satisfied to undertake the charge of purification of the water provided there were no more than 500 colon bacilli to the 100 cubic centimeters. What do you say to that? Would you be satisfied with that, too?

Dr. DE GURSE. Yes; and yet I think that is rather high. That would depend upon the time of the year it was taken. If that were taken in the spring and fall of the year, when we have our worst epidemics, that would be perfectly satisfactory; but if it were taken at this time of the year—July, August, and September—I do not know whether that would be satisfactory or not.

Mr. POWELL. You would want it to exceed that at no time of the year?

Dr. DE GURSE. Yes, sir; I would.

Dr. INCHES. That is true of St. Clair, too.

Mr. POWELL. Dr. Inches, will you kindly have financial reports for your town submitted to us also?

Dr. INCHES. I will if we have them.

The CHAIRMAN. Have you any idea as to what it costs your city for the chlorination of your water, either daily or monthly?

Dr. DE GURSE. No; I have not. I know we were using 4 pounds to the million gallons, and the State sanitary engineer recommended that we use 8, which we are doing at the present time.

Mr. POWELL. Is there any bad smell or taste from the water?

Dr. DE GURSE. Occasionally. Of course when the people think it is in the water there is always a taste.

Mr. CADY. Dr. De Gurse, where do your sewers empty into the river, below or above your intake?

Dr. DE GURSE. There is one that empties above the intake pipe. The rest empty below.

Mr. CADY. How many sewers have you below the intake pipe?

Dr. DE GURSE. About 12.

Mr. CADY. Did I understand you to say that there had been no typhoid cases reported in the territory south of Marine City?

Dr. DE GURSE. With the exception of two or three cases.

Mr. CADY. That has been true for how many years?

Dr. DE GURSE. About 10 or 15 years.

Mr. CADY. What explanation have you to give to the commission for that situation?

Dr. DE GURSE. I haven't any. I can not understand it myself. With the amount of typhoid that we have in our town and our sewers emptying into the river, why the people below are not contaminated I can not understand.

Mr. CADY. Is it not a fact that Algonac is almost free from typhoid?

Dr. DE GURSE. We very seldom hear of a case of typhoid in Algonac.

Mr. CADY. That has been so for the last 20 years?

Dr. DE GURSE. Yes, sir.

Mr. CADY. That is how many miles below Marine City?

Dr. DE GURSE. Eight miles.

The CHAIRMAN. How about the summer residents who take their water directly out of the river?

Dr. DE GURSE. They dip it from near the beach.

The CHAIRMAN. What is the condition of their health?

Dr. DE GURSE. They are in perfect health.

The CHAIRMAN. Is there any typhoid among their families?

Dr. DE GURSE. No; I take care of this population. I saw one case of colitis this last summer, but that was all for the last five years.

Mr. POWELL. Do you find much intestinal disorder down there?

Dr. DE GURSE. Occasionally. We get it in the winter months when we do get it. We get a considerable amount of colitis, which is called in our city "winter cholera."

The CHAIRMAN. How far out does your intake extend into the river?

Dr. DE GURSE. It was extended a short while ago some feet. It is 225 feet out in the stream.

The CHAIRMAN. Do you know the depth of water where the intake is placed?

Dr. DE GURSE. I believe it is about 40 or 50 feet.

Dr. INCHES. Is it not true that most of those people in that territory that you speak of as being free from typhoid use wells?

Dr. DE GURSE. I believe that there are about four or five farmers down there who use wells; that is south. With the exception of those they either draw the water from the river or have a small pipe and a windmill and pump it up into a tank, using their own waterworks system.

Mr. CADY. That territory is very thickly populated, is it not?

Dr. DE GURSE. In the summer time.

Dr. DUFF. Is it not true that Algonac uses a standpipe for their water and that has something to do with the purity of their water?

Dr. DE GURSE. It might be possible.

Dr. DUFF. They pump the water into a standpipe and then it runs to the village.

Mr. POWELL. Is that water exposed to the sunlight?

Dr. DUFF. The standpipe is covered.

Mr. POWELL. Then the destructive effect of sunlight could not account for it.

STATEMENT OF MR. J. W. BREINING, OF MARINE CITY, MICH.

Mr. BREINING. I do not know that I have anything more to offer than what our health officer, Dr. De Gurse, and the mayor have said. Of course, we have a combined sewerage system here, both sanitary and storm system, and we are dumping our sewage into the river in a raw state. When the rest of the cities do something to purify their sewage we are willing to do the same with ours. We feel that the way we are situated down the river below these other places it would not be up to us to take the initiative, but when Port Huron and Sarnia and St. Clair do something with theirs we will gladly try to do something with ours.

The Doctor has explained the sickness. We have had an awful lot of sickness in Marine City. There seems to have been an epidemic spreading over 18 years. However, we have done considerably better this summer. We have tried to stamp it out, but we have not succeeded entirely, although we have reduced the number of cases very much. As to the source of that sickness I would not attempt myself to say whether it was from polluted waters or from what particular source. However, it is there and is very evident.

Mr. POWELL. Has there ever been any movement taken by the incorporated communities below to prevent the city of Port Huron discharging its raw sewage into the river?

Mr. BREINING. None to my knowledge, and I think there has been none.

Mr. POWELL. Has no one ever applied for an injunction?

Mr. BREINING. Not to my knowledge. I think I can safely say that no legal steps have ever been taken to prevent it. Is that right, Mr. Cady?

Mr. CADY. I have never heard of any.

Mr. POWELL. Well, you are a peace-loving community. You are fit for the Kingdom of Heaven. If they smite you on one cheek you turn the other. It is a wonder that some one has not started legal proceedings.

Mr. CADY. I think the profession would be very glad to have your suggestion.

Mr. POWELL. Is there anyone here representing Algonac?

STATEMENT OF MR. H. B. GUNNESS, OF ALGONAC, MICH.

Mr. GUNNESS. We are located on the north channel of the St. Clair River. Our sewage is very limited. We have some 7,200 feet of sewerage, municipally owned, and a water system with a standpipe. Our intake pipe is 150 feet from the shore.

Mr. POWELL. Have you much typhoid fever?

Mr. GUNNESS. We have had one death in three years.

Mr. POWELL. Do you chlorinate the water?

Mr. GUNNESS. We use it in its raw state.

Mr. POWELL. You have become immune.

Mr. GUNNESS. Well, we build a better class of citizens down there, we think.

The CHAIRMAN. How is it down below you?

Mr. GUNNESS. Bradley Beach is a summer resort a few miles below us. There is no system there. Our sewage flows to the westward and empties into the marshes below us. Our combined sewerage comprises 83 homes.

Mr. POWELL. And the raw sewage is thrown into the river?

Mr. GUNNESS. Yes, sir; from the 83 homes; that is, within our limits.

Mr. POWELL. The small amount that you throw into the river would not affect matters very much.

Mr. GUNNESS. That is the way we feel there.

Mr. POWELL. But your community may grow.

Mr. GUNNESS. We hope so.

Mr. POWELL. You do not contemplate taking any steps to purify the sewage?

Mr. GUNNESS. The citizens have not demanded anything. Perhaps our standpipe has something to do with it. Our tank is washed once a month. It holds 50,000 gallons, and the outlet from it extends up in the tank so any deposit of sand or other material drops in this standpipe.

Mr. POWELL. One of the great things to guard against in this matter is the growth of population. I presume along this waterway, including Lake St. Clair, the River St. Clair, and the Detroit River, until you get down to Lake Erie the population must have increased half a million during the past year. If half a million is having this effect, what is going to take place when the population increases to a couple of millions? If sewage is allowed to go in its raw state into this river the whole thing will be a nuisance.

Mr. GUNNESS. The worst time for our water is in the spring of the year when the ice is coming out of the river. We advise our citizens to boil the water. There is very little sickness traceable to the water question.

Dr. DUFF. Your water comes from the north channel of the St. Clair River.

Mr. POWELL. Is that the American channel?

Mr. GUNNESS. Yes, sir.

Dr. DUFF. I raised the question for this reason, that the report of the commission's experts shows that north channel badly polluted.

Mr. GUNNESS. At what points, Dr. Duff?

Dr. DUFF. I do not remember just the report, but I remember that showing from glancing over the report.

Mr. GUNNESS. Our water is entirely from this side of the channel.

Mr. POWELL. You have no sanitary engineer?

Mr. GUNNESS. None at all.

Mr. POWELL. Is there anyone else here representing your community?

Mr. GUNNESS. Yes, sir; Mr. C. C. Smith.

STATEMENT OF MR. C. C. SMITH, OF ALGONAC, MICH.

Mr. SMITH. Gentlemen, there are some peculiar things about these typhoid fever germs. Of course, I do not understand the matter. They have been using quite a lot of words that are all Latin to me.

Algonac does not have but a very little typhoid. The St. Clair River here, after we have had one day of a north wind that is blowing, we will say, 30 miles an hour coming down Lake Huron, will be roily all over. In two days after the north wind stops the river clears up. Whether that roily water comes in from the water on the banks of the river or whether it comes in from the river, I do not know. This water that is now flowing in out of Black River and out of Pine River and out of Belle River is of a reddish cast. In the freshet time when it comes down it is muddy. You go out off my dock and dip up a glass of the water and you can see the waves of mud in it. This morning before I came up here you could see bottom from the dock in 8 or 9 feet of water. This water is perfectly clear there.

In a hard winter, when the rapids here freeze over, you can go out in front of Algonac and cut holes through the ice, and by putting a cover over you to hide the light you can see bottom in 35 feet of water. I do not know why that is the case, whether it is because the sediment does not come in from the top or what the cause is, but it seems to me that if St. Clair and Marine City and the other towns are getting so much typhoid fever out of the sewage, Algonac ought to be getting something. There may be some secret in that standpipe that we are getting our water from that will be a benefit to the other towns. Those germs may settle in that tank and not get into our water. We have only a limited amount of typhoid fever in Algonac.

MR. POWELL. Is there any other community represented here?

MR. CADY. Did I understand from a question asked or from an answer that was given this forenoon that the commission had a sanitary engineer whom it might send to our community to look over the situation?

MR. POWELL. Gov. Glenn asked the question as to whether they would cooperate with any sanitary engineer whom we might send.

MR. CADY. We would be very pleased if the commission could see its way clear to send such an engineer here, especially in the light of the statement made by Mr. Draper this morning. I am satisfied that he thought it was true, but our engineer differs from him as to taking care of the water and the expense that would be involved, and if we could have an engineer from your commission come here and go over the situation with our city engineers it would be of great assistance to us.

MR. POWELL. The matter is one of such tremendous importance, not only to the people of the present day, but to succeeding generations, that I think the commission would feel justified in going to almost any expense in arriving at a sensible or proper arrangement. Have you ever heard of any threat of legal proceedings being taken?

MR. CADY. No.

MR. POWELL. The law is very clear, both in the United States and in England. In England the law provides, in effect, that every riparian owner on a stream is entitled to the use of the water and to consume it for domestic purposes. Outside of that he is entitled to any use of the water he may take, provided he allows it to pass to the riparian owner below him undiminished in quantity and unpolluted in quality. That, I presume, is the acknowledged law in the United States.

Mr. CADY. We so understand it here.

Mr. POWELL. Then every riparian community below could, if the city were the operative party and if it were not done by private corporations, go into a court of law and have an injunction against depositing this raw sewage, because that certainly pollutes the water.

Mr. CADY. There has never been any suggestion of that kind. I remember one time I had occasion to brief that question. We had a sugar plant at Chicago that threw its refuse into the Black River, and a number of farmers consulted to see if they could not get an injunction to prevent them from emptying this refuse into the Black River, claiming that it killed the fish; but that matter was adjusted without the trial of the case.

Dr. INCHES. Is it not true, Mr. Cady, that last year in a city 12 miles from Grand Rapids an individual brought suit against the city for loss by typhoid fever, and that the Supreme Court affirmed the decision?

Mr. CADY. I can not answer the question.

Dr. INCHES. Well, that is true.

Mr. POWELL. I am not here to dispense free law, but I certainly say that there is no question about the liability.

Mr. CADY. You see our peculiar situation is that we spent \$175,000 of our maximum bonded indebtedness, and anything that is going to be recommended that overcomes that figure we have no way of raising the money. We thought if your sanitary engineer could come here and spend some time with our city engineers we might be able to cooperate even to a greater extent than we have expressed our willingness to do.

Mr. POWELL. In the first place, you can not raise the money by taxation, and you are limited to $1\frac{1}{2}$ per cent?

Mr. CADY. That is, for current expenses.

Mr. POWELL. And you can not borrow the money because you have approached the limit.

Mr. CADY. That is true. We are within \$175,000 of our maximum bonded limit.

The CHAIRMAN. While I am not authorized to make the statement, I have no doubt but what the commission will be very glad to cooperate with cities like this—Detroit, Buffalo, and other places—through the work of an expert engineer, in trying to work out some practical and workable plan that will be of benefit to all concerned. Of course, you all understand that this commission does not take any arbitrary stand about this. Our work is largely to investigate and ascertain the facts, and then make such recommendations to the two Governments as we find necessary. I will say, in addition, that I have been especially delighted here to-day to see the interest manifested and the perfect frankness and good nature with which you have discussed this question that is so troublesome to yourselves and to us, and I have no doubt that ultimately we shall be able to work out some system that will be within the reach of all the cities and towns to adopt and that will in a great measure meet the demands of the two Governments.

Mr. CADY. We have spoken a great deal here about Black River, which extends probably for 50 miles in a northerly and westerly direction from this city. In addition, there is a river that comes out

from St. Clair, known as Pine River, and that must act as a drainage for a considerable territory. How many miles, Dr. Inches?

Dr. INCHES. Thirty or forty miles in freshet times.

Mr. CADY. Then, in Marine City there is Belle River, that must run about the same distance, and must act as a drainage for considerable territory. It would seem to me that some tests should be made of those waters to see if there is not considerable sewage coming down from those streams during the spring freshets.

The CHAIRMAN. My judgment is that our jurisdiction would be confined very largely to the boundary waters. The tributaries inland would come under the jurisdiction of the State boards. Do you not think that is true, Mr. Powell?

Mr. POWELL. That would be as a separate independent subject of jurisdiction, but I think we could take cognizance of the indirect contamination of these rivers through their affluents. It is a question of whether the boundary water is polluted, and then it is a question of whether it is polluted immediately or through the effect of affluents.

Mr. CADY. The question immediately arises that if the cities are going to be asked to do something with their sewerage system to purify the water in St. Clair River, and these three streams are pouring in sewage, there is not much use of asking us to do it unless some steps are going to be taken to have those people look after their sewage. It does not seem to me that your work will be complete unless you take care of that situation.

Mr. POWELL. We will do everything you suggest.

Before we close, Mr. Chairman, I would like, on behalf of my conferees on the commission, and especially on behalf of the Canadian branch of the commission, to express my feelings of gratitude for the kind manner in which we have been treated. I do not intend to make a speech. I am a man not of words but of deeds, and speaking is not my forte—I might say, unaccustomed as I am to public speaking. I must, however, say one thing, and that is this: The history of the world, gentlemen, affords not a parallel to this institution, whose humble personnel have appeared before you to-day, with the exception of Mr. Tawney. About 2,000 years ago the old prophetic voice of peace among nations and the sword being beaten into a plowshare was emphasized by the Savior of mankind. He announced to the world a new principle, or emphasized a new principle—the brotherhood of man and the Fatherhood of God and peace upon earth. From that time to the present struggling humanity, anxious mothers whose children were torn from their knees, anxious fathers whose aspirations and hopes built upon their sons, anxious daughters and anxious sons whose fathers were borne to war, looked forward to the time when the common sense of humanity would hold the world from war; and we expected, gentlemen, that we were about reaching that time when nations should know war no more.

In this commission the two most politically enlightened portions of the world agree that all these difficulties along their immense border line should not be a subject of war, but should be referred to a committee to decide in accordance with the principles of law and justice. We have the power to decide absolutely all questions affecting the

interruption and the diversion of these boundary waters. We have power additional, too, when they are reported to us, to decide all matters of dispute bordering upon the boundary line. We have jurisdiction to decide each and every question at issue between these two great Empires that may be referred to us.

Never before in the history of the world has the great Christian common sense of humanity been crystallized in such an institution as this. We should pride ourselves upon it. These two great nations lie alongside of the international boundary line, we to the north who may possess a somewhat larger country territorially than you, and you to the south who possess, I must acknowledge, generally a richer and more fertile country and a more benign climate than we, but we must remember that we have sprung largely from the same source, that our interests are one, and cursed be he who ever raises the red hand of war between these two communities.

In your trials you almost misunderstood us in Canada. In the first place, the great historic trouble that separated the daughter from the mother was one of which both parties feel ashamed I might almost say to-day. You misunderstood the mother country. The mother country was not the power that induced the war. The war flowed from the brain of a man who spent a large portion of his life as a lunatic in the care of a guardian. The great hearts of the British people never were in favor of it; and amid all our trials and difficulties, although there was a little spirit of emulation and desire of one to exceed the other, we knew that there was no need of fortification to protect Canada against the United States nor to protect the United States against Canada.

In your great War of the Rebellion thousands and thousands of Canadian subjects flew to arms and swelled your regiments and gave to your immortal President Lincoln the power to unfurl that greatest of proclamations that ever made glad the heart of man or raised in the estimation of the world the emancipation of the slave. This feeling never was so intense as it is at this moment, and, while the greater portion of the civilized world is at war, we do not ask of you any support; we ask you to be, as your President in his wisdom has requested, entirely neutral in the struggle, but we know that we have the prayers of the American Nation, this great struggle that is now going on, that eclipses in its violence, in its immensity, and in its issues all the struggles that earth ere knew before. We know that your desire is that justice and right prevail, and that speedily the flag of peace shall be unfurled and the temple of Janus closed forever to the human race.

I have much pleasure, gentlemen, in thanking you again for your kindness, and we shall now go and enjoy a drive around your city to see those great evidences here on the banks of this the greatest commercial highway in the world, of the people of whom Gladstone said and truly said, they were the greatest example of industrial force and knowledge of which the world had a record. [Applause.]

The CHAIRMAN. Gentlemen, I submit that you will be willing to acknowledge that considering this is Mr. Powell's first appearance in public that he did a very good job. The meeting now stands adjourned.

(Thereupon, at 4.15 o'clock p. m. the hearing at Port Huron was adjourned.)

INTERNATIONAL JOINT COMMISSION,
Sarnia, Ontario, Friday, October 2, 1914.

The International Joint Commission met at Sarnia, Ontario, on Friday, October 2, 1914, in pursuance of the consideration of the reference in relation to the pollution of boundary waters.

Present: Th. Chase Casgrain, K. C. (chairman) presiding, Charles A. Magrath, R. B. Glenn, Lawrence J. Burpee (secretary).

APPEARANCES.

Dominion Government: Dr. Montizambert, C. M. G., superintendent general of public health.

Province of Ontario: F. A. Dallyn, representing provincial board of health.

Municipalities represented: J. B. Dagan, mayor of Sarnia; R. I. Towers, city solicitor; Alderman Thomas Doherty; Alderman Proctor, chairman of finance; H. A. McLean, city engineer. Moore Township.—Dr. F. R. Seager and D. P. Shaw, reeve of the township.

Mr. CASGRAIN. I suppose you have received a copy of the letter which was sent to you by our secretary, in which your attention has been called to the reference which has been made to this commission upon this important question of the pollution of boundary waters. Having ascertained by our experts that there was pollution in all the boundary waters, we have now come to the stage when we are seeking a remedy to prevent the water being polluted, and we have come to confer with you upon any means you may suggest to remedy the state of things which our experts have found to exist. We also sent a copy of this letter, notifying them of this meeting, to the municipalities of Point Edward, Corunna, Mooretown, Courtright, Sombra, Port Lambton, Wallaceburg, Petrolia, Moore Township.

I may say that the commission intended to sit here to-morrow, but we found that the progress of business enabled us to be here this afternoon. However, if you gentlemen wish us to remain over until to-morrow we shall be pleased to do so.

Mayor DAGAN. We shall be able to present all we have to say in a very short while, and it will not be necessary for you to remain over, but I extend to you an invitation to see our waterworks and our sewerage system here, after the meeting.

Mr. CASGRAIN. We shall be very glad to do so.

Mr. TOWERS (city solicitor, Sarnia). I was commissioned by his worship the mayor and the committee having charge of this matter to attend your meeting here to-day and to extend you a cordial welcome to the city of Sarnia and at the same time to express the appreciation we have of the high character of the service which the commission has been rendering and is rendering in ascertaining means by which effect may be given to the agreement which has been reached between the United States of America and His Majesty's Dominion of Canada, having regard to the preservation and the conservation and the use of the boundary waters. I have read with some care and a great deal of interest the reports which have been already presented by your experts and sanitary engineers to the commission and also the progress report of the commission.

So far as the position of the city of Sarnia is concerned, I am instructed to say that the corporation is more than desirous of assist-

ing in any way within its power the investigation conducted by the commission and the attaining of its objects.

The municipality, moreover, places itself in the hands of the commission, as it were, so far as anything that they may ultimately direct it to do to correct or remove any injury or abuse that may be found to have accrued from its use of the boundary waters. At the same time I am instructed to ask your full consideration to the rather unique position which the city of Sarnia occupies, as may be gathered from the evidence already before your honorable body, having regard to the use of the waters of the St. Clair River by the city for the discharge of its raw sewage. That practice, rightly or wrongly, of using these waters for the discharge of raw sewage has, of course, obtained in this city for very many years, practically since its inception. The principal discharge of the sewage of the city takes place at Cromwell Street, which is a central thoroughfare in the business district of the town, and also at Devine Street, where there is a smaller sewer. I take it that this commission is not particularly concerned with the effect that the discharge of that sewage may have on the water supply of Sarnia, but I may state for your information that the municipal authorities have now completed and will install in the course of a very few days a waterworks system drawing its supply through filtration from Lake Huron, some 2 or 3 miles above the town. So far as this is concerned, danger to the inhabitants of the city of Sarnia or Point Edward or places on the St. Clair River will practically be abolished in the future. We have suffered somewhat from typhoid epidemics here in past years, which were considered to be attributable to our water supply. I am glad to say that that danger to the health of the community can not recur.

If you would be pleased to note the peculiar geographical position of the town, I may say that the city of Sarnia and the adjacent municipality of Point Edward lie on the northerly and easterly bank of the upper portion of the St. Clair River. The St. Clair River enters through a narrow channel between Point Edward and North Port Huron, and the sweep of the current across Sarnia Bay, and past the city of Sarnia, as I think can readily be shown, indeed it is perceptible, is in a southerly and easterly direction and following the Canadian shore. The chief and most speedy part of the current follows the Canadian shore, so that the sewage from Sarnia, entering at Cromwell and Devine Streets, is caught up by the swift current, of some $4\frac{1}{2}$ miles an hour, in a very large body of water, discharging, I should estimate, some 30,000,000 cubic feet per minute, and carried down the Canadian shore.

I do not profess to make any general statement that none of the sewage is carried toward the center of the stream, but I think the evidence would show that by far the greater part of it is carried comparatively close to the Canadian shore.

Immediately south of the town we have an Indian reservation of some 6,000 acres, having a river frontage of about 5 miles. There is no communal water supply on that reserve, whatever water being necessary being taken by the individuals from the river for their own domestic use.

Mr. CASGRAIN. How many Indians are there?

Mr. TOWERS. There are 339, I think.

Mr. CASGRAIN. They have no system of sewerage?

Mr. TOWERS. They have no system of sewerage and no waterworks. Following the river, in the small village of Froomfield, there is no system of sewerage and no waterworks system. Seven miles down from Sarnia we have the village of Corunna, which likewise has no sewerage system and no waterworks system. Three miles farther down there is the small village of Mooretown, which is in precisely the same position. The inhabitants of Froomfield would number less than 100; Corunna, 250; Mooretown, 100, and Courtright, 12 miles down the river, has a population of possibly 600. Courtright has no municipal system of waterworks and no sewerage system. Further down the river there is a fairly sparsely settled farming district, and about 20 miles down we come to the village of Sombra, which has a population of 800 and has no sewerage system and no waterworks. Stag Island is opposite Corunna, about 7 miles below Sarnia. Eight miles farther down there is the village of Port Lambton, which brings us down to Walpole Island, near the discharge of the river, and this is a village of possibly 500, and has no sewerage system and no waterworks system. Generally speaking, that is the condition on the Canadian shore, from the head of the river down to Walpole Island, where the river delta begins.

I was reading the evidence given before you of Mr. Fuller, Mr. Whipple, and Mr. Dallyn, and to one not possessed of expert knowledge in these matters their statements are illuminating. Their evidence seems to be given with such clearness and knowledge that it enables one acting on behalf of a municipality to form some idea of what the conditions are and what steps should be recommended. From page 13 of Mr. Fuller's evidence I quote:

Mr. POWELL. The next question is: Do you consider that unrestricted discharge of crude sewage into the Great Lakes or their connecting rivers should be permitted to continue? What have you to say as to that, Mr. Fuller?

Mr. FULLER. No. I think that the unrestricted discharge of crude sewage into the Great Lakes or the connecting rivers should be brought to an end, and that a reasonable and progressive control should be had over the discharge of the sewage. In making that answer I will say further that I believe that reasonable account should be taken of the ability of the water to absorb sewage by dilution, but, even so, I believe that the sewage should be subjected to some treatment and that the unrestricted discharge of sewage should come to an end.

I call your attention to this portion of Mr. Fuller's answer:

I believe that reasonable account should be taken of the ability of the water to absorb sewage by dilution.

And then he says that the sewage should be subjected to some treatment and that the unrestricted discharge of sewage should come to an end. I quote from the bottom of page 17 and page 18:

In waterways, where some pollution is inevitable and where volume is such that no general nuisance can result, do you consider that proper sewage disposal by dilution represents a natural resource and that the utilization of this resource is justifiable for economic reasons, provided that an unreasonable burden or responsibility is not placed upon any purification plant, and that no other menace to the public health is occasioned thereby?

There is considerable dubity about this unreasonable burden, in my mind, but you can wrestle with the question to the best of your ability.

Mr. FULLER. My answer is that I do consider that proper sewage disposal by dilution represents a natural resource, and that the utilization of that resource is justifiable. The whole keynote of the proposition is a matter of keeping that burden, or responsibility, where it belongs.

Mr. Fuller evidently had in mind a certain amount of regard for the financial limitations of the smaller municipalities particularly, and on page 20, in answer to Mr. Powell, he says:

Mr. POWELL. Generally speaking, which is the more economical, to purify your water by chlorination at the intake or to purify the sewage discharge?

Mr. FULLER. It is cheaper to purify the water at the intake.

I trust I am not wearying you by going over what is no doubt very familiar to you, but I wish to emphasize, so far as properly I may, the viewpoint of the municipality of the city of Sarnia. To quote from page 23:

Dr. STARKEY. I would like to ask Mr. Fuller whether or not he agrees with the fact that fresh sewage should be looked upon as more dangerous than remote sewage; that is, sewage that has been in the water for a long time?

Mr. FULLER. Other things being equal, that is so, because disease germs do not multiply in water but progressively and gradually die, so that the older and more remote the pollution is the less is the potential danger to health.

The town of Sarnia occupies a strong position in this way, that it is situated where the volume of water is large and the flow rapid; and I should think, from my own knowledge, that whatever benefit might accrue to rapid dilution would accrue to the town of Sarnia.

That appears to be borne out by the tests which were taken of the water on the authority of your commission and which are contained on page 33, opposite plot No. 9 of the progress report. This shows that a number of sampling points were distributed over the St. Clair River in the region which I have indicated, those numbering from 48 to 191, and again from 306 to 313. Points 41 to 44 are at the narrows or head of the river where the river empties from Lake Huron, and there, without going into the different bacteriological counts per cubic centimeter, I refer only to the number of bacilli coli per cubic centimeter by Phelps's method, which I believe is the standard adopted by the commission and referred to in the evidence of the sanitary engineers. We find at the narrows, at the foot of the lake, the number is very small.

Point 41	3.7
Point 42	6.0
Point 43	19.0
Point 44	9.1

This brings us across to the Canadian bank. The next line of sample points crosses, I should judge, just about opposite the Cromwell Street sewer discharge, and is numbered from 48 to 56.

Point 48	23
Point 49	24
Point 50	69
Point 51	13
Point 52	11
Point 53	16
Point 54	32
Point 55	25
Point 56	158

If I am right in my judgment of the approximate position of that line of sampling points, the 158 count should show the very worst conditions which obtain opposite the town of Sarnia. It may be that is above the Cromwell Street sewer. But the view I take is that these samples are not of such great importance as a guide to the deliberations of your commission as the lower line or the next line of

points from No. 60 to No. 66. That crosses below the town, well below the town, and below the discharge of any sewage that comes from the town. Opposite sample point 60, which is on the American shore, the number of *B. coli* appears to be 130. At point 61, a little over from the American shore but still on the other side of the river, the count is 8.5. At station No. 62 it is 7.5, at station 63 it is 6.8, at station No. 64 it is 4.9, at station 65 it is 11, at station No. 66 it is 31. Down below the Imperial Oil Works, or at the Imperial Oil Works, in a very thickly populated part, we find on the American shore, opposite point 172, 2,405, which is a comparatively large count. At station 173 it is 151. In the center of the channel, which is very little used, opposite No. 174, the count is 47.

Coming to the Canadian side to the center of the river, opposite station 175, the count is 15, and close in, at station 176, the count is 193, which is the largest count found anywhere opposite the town of Sarnia and below its discharge.

Going farther down the river to stations Nos. 67, 68, and 72, across the river well south of the town, opposite the Indian reserve, on the American side, we find fairly high counts for that portion of the river, removed as it is from any immediate source of contamination.

At station 67 it is 55; at station 66 it is 87. Coming to the Canadian side we find in the center of the river, at station No. 4 and station No. 1, the count is 6 on the Canadian side of the center. At station No. 27 in the ship channel, which is on the Canadian side about halfway between the center of the river and the Canadian shore, and inshore on the Canadian side, the count is only 12.

If I am correct in my reading of the opinion of your sanitary engineers, Messrs. Fuller, Whipple, and Dallyn, they seem to agree that purification is quite efficient, and that it can not be said that a purification plant, other things being equal, was overloaded where the count is not more than 500 *B. coli*. to the 100 cubic centimeters. If I am correct in that reading, the water tests opposite Sarnia and down the river from Sarnia at the only points of the river where Sarnia sewage could be said to exercise its detrimental influence show the count to be very much less than that. The highest count is 193 and the lowest 1 or 2.

So that, without in any way wishing to avoid any duty or any obligation you consider properly to be placed on Sarnia, we do make the point that so far as any damage comes from the discharge of Sarnia's sewers into the water, according to the evidence given and the tests made, it would appear that protection at the intake could handle, and could properly be asked to handle, all the injury that has been caused.

Mr. CASGRAIN. At station 172, on the American side, the count appears to be 2,405. Can you tell me if you know of anything which would cause such an intensity of pollution at this point?

Mr. TOWERS. If you look a little northerly on the American shore from the point to which I have referred, if you will look to the sampling points 57 and 58, you will see that the Black River enters the River St. Clair. Black River is the river from which the ferr- leaves and is opposite sampling point 58, which is a little above the bridge there. It will be noted that the count is 4,257. At sampling point No. 57 the count is 2,631. I think the condition of Black River, with the industries and the comparatively large population along its

shores, as the inhabitants of Port Huron and Sarnia have known it for a good many years, will account for the large count a little below its effluent.

There is only one other point I would ask the attention of the commissioners to, and that is a reference to Mr. Fuller's evidence. I am referring to Mr. Fuller's evidence, not because the evidence of Mr. Whipple and Mr. Dallyn do not cover the same points, but because it comes first, and I find very little difference of opinion among them. I quote from page 27:

Even if water-purification plants properly constructed and efficiently operated existed in all municipalities do you consider that indiscriminate discharge of sewage by vessels should be permitted.

Municipalities, of course, means communities bordering on the waters.

Mr. FULLER. I am inclined to think that it would not make a great deal of difference, so far as the municipalities are concerned, if they had sufficient water-purification plants, whether the discharge of sewage from the vessels is practiced or not. I believe that a great deal of care should be exercised in having vessels supplied with water in a port of a quality that is above reproach, and that the indiscriminate taking of water by vessels is something that ought to be stopped. There is still another angle, and that is the question of whether the sewage of vessels does not make it rather dangerous, perhaps, around bathing beaches. I have heard that matter discussed rather seriously, but more particularly as regards city sewers themselves. It has also been discussed from the angle of what the sewage of the vessels might do in affecting public health at beaches, but that is a pretty small matter, it seems to me, on present evidence.

Mr. POWELL. What would you say with regard to the discharge of sewage from vessels at the intakes of these connecting rivers?

Mr. FULLER. I do not think it is a desirable thing to do; but if the water supply is well filtered, I do not believe that it should seriously overtax the capacity of the filters.

I refer to that not as having any direct bearing upon the point at issue, because we are not as a municipality concerned in what regulations may be imposed on vessels, but merely as showing clearly that in Mr. Fuller's opinion—and I think it is the opinion of the other sanitary experts, and also from the standpoint of common sense—that purification of the water can take care of a very considerable amount of contamination. The vessels that go up and down here discharge their untreated sewage into the river, and they are many in number, and if Mr. Fuller is of opinion that their sewage can be taken care of by purification, it perhaps lends indirectly a little aid to the position that we would urge upon the commission or respectfully suggest to it that the damage from Sarnia sewers may fairly be taken care of by purification of the water. I should add to that further that if the commission come to the conclusion that Sarnia sewage should receive some treatment these circumstances to which I have referred, our geographical position, the volume of the body of water, its speed, the advantages from dilution which accrue to us, and the contour of the river, which is rather in our favor, should be taken into consideration, and might properly be taken into consideration in determining what degree of treatment should be required from municipalities situated as Sarnia is.

I may say, though perhaps it is not necessary, that discharging as we do deep in the ground and far below the street level in the very center of our business community, the installation of a treatment plant and the necessary changes that would have to be made in our sewerage system would be financially, if it had to be borne by

the municipality, a very heavy burden. I think perhaps more so than in the case of cities such as Port Huron, which I notice by the report of your engineers, discharges largely at the surface of the water. The installation of a pumping system to treat the sewage at the depth a treating plant would have to be placed to receive the flow naturally would impose a very heavy burden on the municipality.

I do not know that I can add anything more in the way of a statement to your honorable body. I have not prepared any evidence to offer to you, but we shall be more than glad to give you any information or call any evidence which we may wish to hear that can be of the slightest service in assisting you to arrive at a conclusion.

Mr. CASGRAIN. Mr. Towers, the commission is very much obliged to you for the very interesting and fair statement you have made. We would like to hear the city engineer.

(H. A. McLean (city engineer, Sarnia) was then called.)

STATEMENT OF MR. H. A. McLEAN, CITY ENGINEER, SARNIA, ONTARIO.

Mr. CASGRAIN. Have you prepared a statement to lay before the commission, or would you rather that we should ask you questions?

Mr. McLEAN. I would prefer to have questions asked.

Mr. CASGRAIN. I understand there are two main outlets to the sewers here?

Mr. McLEAN. Yes.

Mr. CASGRAIN. Are there any others?

Mr. McLEAN. There are two more.

Mr. CASGRAIN. Emptying into the river?

Mr. McLEAN. Yes; there are two smaller ones—one at Wellington and one at Clifford Street.

Mr. CASGRAIN. What is the frontage of the city on the river?

Mr. McLEAN. It is probably 2 miles.

Mr. CASGRAIN. Do you know anything about Point Edward; is it a separate municipality?

Mr. McLEAN. Yes.

Mr. CASGRAIN. Do they empty their sewage into the river?

Mr. McLEAN. There is no sewage. It is a sandy and gravelly soil, and they use cesspools.

Mr. CASGRAIN. Can you tell me how much sewage enters into the river from the city here?

Mr. McLEAN. I can not state that; it has never been estimated. It is a combined storm and sewerage system.

Mr. CASGRAIN. How low down is the mouth of the sewer situated?

Mr. McLEAN. The Cromwell Street sewer is probably in the neighborhood of 6 feet below the water level.

Mr. DALLYN. It is the outlet that is submerged; the sewer itself is above water level?

Mr. McLEAN. That is right.

Mr. CASGRAIN. What about the other sewers?

Mr. McLEAN. The Devine Street sewer is about halfway submerged; it is not entirely submerged. The Clifford and Wellington Street sewers are not submerged.

Mr. CASGRAIN. Has it ever occurred to you that at some future time it would probably be necessary for you to treat the sewerage

from the city, and have any plans been devised by which that would be done or any calculations made to show how much it would cost?

Mr. McLEAN. I have not gone into the cost; I have gone into a plan.

Mr. CASGRAIN. What have you to say as to that?

Mr. McLEAN. The plan I had, that perhaps would suit the city best, would be to put in intercepting sewers and carry it to the Devine Street outlet.

Mr. CASGRAIN. What would you do with it there?

Mr. McLEAN. There it could be treated.

Mr. CASGRAIN. Would that be a costly operation?

Mr. McLEAN. I can not estimate what it would cost, but it would be the least costly I know of. I have not prepared any calculations.

Mr. CASGRAIN. What would be the length of that intercepting sewer?

Mr. McLEAN. You would probably need two; one at Mitten Street and one at Christina Street, and one from Clifford Street north to Devine Street; the length would be about $1\frac{1}{2}$ miles. The Cromwell Street sewer carried to Devine Street would be 4 feet 6 in diameter, and the Mitten Street would be 4 feet in diameter, and then the Clifford Street sewer would need to be at least 3 feet.

Mr. CASGRAIN. Is the population of the city of Sarnia growing?

Mr. McLEAN. Yes.

Mr. CASGRAIN. What is the population now?

Mr. McLEAN. Ten thousand.

Mr. CASGRAIN. What was the population last census?

Mr. McLEAN. Nine thousand nine hundred and sixty-seven; we think it is nearly 12,000 now.

Mr. GLENN. How do you treat your water?

Mr. McLEAN. With chlorine; they inject it into the discharge.

Mr. GLENN. What was the condition of that water before you commenced to treat it?

Mr. McLEAN. The experts told us it was not fit to use.

Mr. GLENN. You treat it now and you think it is very much better?

Mr. McLEAN. Yes.

Mr. GLENN. What effect has it had upon the health of the people?

Mr. McLEAN. It has cut down the rate of typhoid very much.

Mr. GLENN. Do you know how much?

Mr. McLEAN. I can not tell.

Mr. GLENN. I have been very much impressed with Mr. Towers's argument. I want to say to you, sir, that you showed more study of the case than any lawyer who has addressed us since we started out on this inquiry. You certainly made a good case, and most of the lawyers who appeared before us have not been able to give us that help which you have given. I want to ask you how many miles is it from where you empty into the river before there is any municipality on your side? How many miles below your sewer is there a municipality which takes water from the river?

Mr. TOWERS. I do not know of any municipality which takes water from the river on the Canadian side; they all have wells for 30 miles down.

Mr. GLENN. Is there none between Windsor and this place?

Mr. TOWERS. There is Walkerville, which is near Windsor.

Mr. DALLYN. And Wallaceburg.

Mr. TOWERS. That is 9 miles from the boundary waters.

Mr. GLENN. Do you keep this sewage on your own side or do you send some of it to the American side?

Mr. McLEAN. The current is very strong toward us.

Mr. GLENN. Then we give it to you instead of you giving it to us?

Mr. McLEAN. I suppose so.

Mr. TOWERS. Wallaceburg is situated on a tributary of the St. Clair, and the flow is from Wallaceburg to the River St. Clair, a distance of some 9 miles. I know also that the count around Wallaceburg is well up in the thousands—between 3,000 and 4,000. I think we can hardly be said to injure Wallaceburg.

Mr. CASGRAIN. None of your sewerage can go to Wallaceburg?

Mr. TOWERS. No.

Mr. DALLYN. The flow of the river is from the St. Clair. The river that runs through Wallaceburg goes down another channel and empties below the town. They will have to put in a purification plant at Wallaceburg.

Mr. GLENN. From this point where the sewer goes into the river to the first place below where you have a waterworks, what is the average count down that river?

Mr. DALLYN. The average count is somewhere around 12 B. coli. per 100 cubic centimeters. It is quite low. The municipalities below Sarnia on the Canadian side have all had a very sad experience from river water, and as a consequence they have used deep wells, and sometimes in the late fall when the wells get dry, they resort to the river. Perhaps the medical officer from Moore Township will be able to tell us something about that.

Mr. GLENN. How do you account for the low percentage below Sarnia?

Mr. TOWERS. The bulk of the sewage entering the river is comparatively small and it is tremendously diluted. Here we discharge 10,000,000 gallons per 24 hours, which is about 20 cubic feet per second. The flow of the river is about 198,000 cubic feet per second, so that there is enormous dilution of this small volume of sewage.

Mr. GLENN. Is there much damage from this sewage down on the Canadian or American side?

Mr. DALLYN. It is perceptible, but damage is rather a hard word to define; it is infective.

Mr. GLENN. It could be treated at the intake?

Mr. DALLYN. It would require purification plants at any intakes down the line.

Mr. GLENN. Would that not have to be done whether you had Sarnia here or not?

Mr. DALLYN. If disinfection takes place here, you reduce the hazard of possible infection by actually reducing the number of bacteria on the plant that would be designed to take care of it.

Mr. GLENN. Have you made any rough estimate, Mr. McLean, of what it would cost you to treat your sewage by sedimentation, fine screening, or chlorination?

Mr. McLEAN. No.

Mr. GLENN. You have made no calculation as to what an intercepting sewer would cost?

Mr. McLEAN. No.

Mr. MAGRATH. How long have you been engineer here?

Mr. McLEAN. Eight years.

Mr. MAGRATH. What university?

Mr. McLEAN. Ann Arbor, Mich.

(Mr. W. J. Proctor was then called.)

STATEMENT OF MR. W. J. PROCTOR, SARNIA, ONTARIO.

Mr. CASGRAIN. Do you publish an annual financial statement of the city of Sarnia?

Mr. PROCTOR. Yes.

Mr. CASGRAIN. Is it printed?

Mr. PROCTOR. Yes.

Mr. CASGRAIN. Can you get several copies of it and give it to us?

Mr. PROCTOR. Yes.

Mr. GLENN. What is the total valuation of property in the city?

Mr. PROCTOR. The assessment is up to \$6,000,000.

Mr. GLENN. What do you base it on, is it full value?

Mr. PROCTOR. They never go to the full value.

Mr. GLENN. If you did, you would be the first town I ever heard of that did.

Mr. PROCTOR. I imagine that is so.

Mr. TOWERS. Our tax rate is 26½ mills.

Mr. PROCTOR. That is owing to the large expenditure we made in going to Point Edward for our water, which amounts to \$240,000, and we have been putting in a number of sewers. I may say that I have lived on the banks of the St. Clair River all my life. I was born at Froomfield. I have used the river water all my life.

Mr. CASGRAIN. And you are still living?

Mr. PROCTOR. I am still living.

Mayor DAGAN. And he never drank anything but water.

Mr. CASGRAIN. You must be immune.

Mr. PROCTOR. All the Indians living on the bank of the river simply get a pail and go down to the river and dip it in from the shore, and the people living along the banks of the river do the same thing. The people of the villages of Mooretown, Courtright, Sombra, and so on, carry the water from the river in a pail. I did the same myself for many years, when I had a windmill erected and pumped the water right from the shore.

Mr. MAGRATH. How long do you think you would live below Detroit and do that?

Mr. PROCTOR. I do not know. I was in Detroit during the American War, and they had a heavy revenue from whisky, and the people seemed to get along with the water all right. At the store I was in they bought whisky at 17 cents a gallon and I retailed it over the counter at \$4 a gallon.

Mr. GLENN. I should think that two doses of Black River water would lay most people out.

(A. J. Johnston, of the board of health, Sarnia, was then called.)

STATEMENT OF MR. A. J. JOHNSTON, OF THE BOARD OF HEALTH OF SARNIA, ONTARIO.

Mr. CASGRAIN. Are you perfectly satisfied with the conditions that prevail here in connection with your water service?

Mr. JOHNSTON. As it stands now, yes, with the chlorination.

Mr. CASGRAIN. What amount do you use?

Mr. JOHNSTON. They vary the quantity considerably. At our intake pipe, where it is situated at the present time, something of the purity of the water depends on the winds. When it is a south wind and stirs up the bottom of the bay out here, which it does when it is a heavy gale, our water conditions are worse and then the chlorination is increased by about one-half.

Mr. CASGRAIN. How much do you usually use?

Mr. JOHNSTON. We use 9 pounds to the 1,000,000 gallons at present.

Mr. CASGRAIN. That quantity was established by the health department at Toronto?

Mr. JOHNSTON. It was through an investigation of theirs that was held here two or three years ago.

Mr. MAGRATH. Is it noticeable in the water?

Mr. JOHNSTON. If you use it in the bathtub, it is noticeable. I have never been able to taste it, but I think some claim they can.

Mr. MAGRATH. What is the sentiment of the people about the manner in which you handle the sewage here; that is, dumping the raw sewage into the river?

Mr. JOHNSTON. I think the consensus of opinion is that with the volume of water that passes here and the small amount of sewage we have in comparison with it, that very little infection can take place at any place whatever down the river, where the next intake pipe is.

Mr. MAGRATH. On general principles, do you think it right that raw sewage should be dumped into a stream like that?

Mr. JOHNSTON. Would that not depend on the distance the next place is down that uses the water?

Mr. MAGRATH. Of course, your town is going to grow?

Mr. JOHNSTON. I would agree that if we were polluting the water taken by any municipality they would have the right to object; but with the present figures, as given by Mr. Towers, and judging from the report of the engineers, I hardly think we are doing that.

Mr. MAGRATH. Is the sewerage system here quite satisfactory to the health department at Toronto?

Mr. JOHNSTON. They did raise objection to our water system, and of course you have been told of the expenditure we are making to improve our water system. I do not know that our sewerage system has ever been objected to.

Mayor DAGAN. We submit our plans to the department at Toronto before we go on with our work.

Mr. MAGRATH. And they have not objected to your dumping raw sewage into the river?

Mayor DAGAN. I do not think they have. I have no knowledge of it.

Mr. GLENN. It used to be the idea that water purified itself every 7 or 9 miles, but the experts hold, I believe, that that is not correct.

Mr. JOHNSTON. When I studied these things as a boy I was under the impression it purified itself quicker than that.

Mr. GLENN. When I was a boy I thought it purified itself over every seven rocks, but it does not. We were told at Buffalo that sweeping it over Niagara Falls and down through the Whirlpool Rapids only churned it up; in fact, that the water was worse than if it ran slowly and was allowed to settle. My childhood faith is upset.

Mr. Proctor stated that the assessed value of the city was \$6,472,403, and the population, according to the municipal census, 11,503. He said there were quite a number of fixed assessments, such as the Grand Trunk, the Imperial Oil Co. The Grand Trunk is only assessed at \$20,000 and the oil company at a small amount. These assessments do not run out until 1919. The tax rate was 26½ mills last year. That was more than it ever was before, and it was due to the extension of the water main to Point Edward. The bonded debt of the city was between \$700,000 and \$750,000, and that included the new waterworks.

(Alderman Doherty was then called.)

STATEMENT OF ALDERMAN DOHERTY, SARNIA, ONTARIO.

Mr. CASGRAIN. You are one of the aldermen of the city?

Mr. DOHERTY. Yes; I am a member of the fire and water committee.

Mr. CASGRAIN. If you have anything to add to what the other gentlemen have said, we would like to hear you.

Alderman DOHERTY. I can not add anything to what Mr. Towers has said.

Mr. CASGRAIN. Mr. Towers covered the whole matter very thoroughly.

Alderman DOHERTY. I am strongly impressed with the idea that our sewerage does not carry far down the river. I took the analysis made by Mr. Dallyn in proof of that. Just below the street sewer it is 220, down the river only 77, a little farther down the river it gets less, and when you get out in the center of the river the water is pure. It would appear that the acids that come from the oil refinery destroy the colon bacilli, so that the count is very small below that. One peculiarity about that is that it does not hurt the fish, because the fish are caught there as usual, and they are fine, fat fish.

Mr. GLENN. How many towns are above you on this side of the river?

Alderman DOHERTY. None.

Mr. GLENN. If your water was so bad that the provincial authorities pronounced it impure, where do you think the impurity came from?

Alderman DOHERTY. The intake pipe was broken at the time the analysis was taken. It was broken near the shore by a ship, and that was the time the epidemic of fever broke out.

Mr. GLENN. Do you think that was on account of the imperfect water system you had at that time?

Alderman DOHERTY. Yes; but that system is all changed. The new water supply will be put on, I think, to-morrow.

Mr. MAGRATH. We can not get you to admit that you think your sewerage should be treated.

Alderman DOHERTY. Well, I don't know. Probably by the time we get the sewerage treated, with the wonderful research going on all the world over in this connection, there may be some better system discovered that will knock our present system higher than a kite.

Mr. GLENN. There is one thing certain, and that is that Sarnia has made a good showing, or else you stand together better than the people on the other side.

Mr. McLean, city engineer, was again called.

STATEMENT OF MR. McLEAN (CITY ENGINEER).—Continued.

Mr. CASGRAIN. Mr. McLean, have you seen the plan of the sewers of the town of Sarnia, which is printed in the progress report?

Mr. McLEAN. I have glanced over it; I had not time to go into a study of it thoroughly.

Mr. MAGRATH. Have you blue prints showing your sewerage system up to date?

Mr. McLEAN. No; they are on separate plans.

Mr. CASGRAIN. Is that all the city of Sarnia has to present to the commission?

Mayor DAGAN. Yes; I think so. Mr. Towers covered the ground very thoroughly.

Mr. CASGRAIN. He did indeed.

Mayor DAGAN. There is nothing more we have to offer at the present time. Unfortunately, three years ago we had a typhoid epidemic, which was mainly caused by an accident. At that time there happened to be a pipe 100 or 200 feet from the shore. Our intake at present goes out 560 feet. It was in 1911 that we had the epidemic. About that time the steamer *City of Genoa* was wrecked 100 feet below our main sewer and there was a 10-foot hole in her bow. She remained there for about three weeks. She was loaded with corn and wheat and part of her cargo was thrown over into the bay, and the Sarnia citizens for a month could not stand the smell in the north part of the bay. I believe that the balance of the cargo was taken to Cleveland and pan dried. We have had no fever here of late.

We have changed our waterworks system, and to-day we have a new system. So far as our sewer system, I really think we have as good a sewer system as there is in the country. It has cost us a lot of money, and so far as our water goes it will be good drinking water. I was not in favor of spending \$250,000 or \$300,000 of the people's money to go to the Point, because I always considered we had very good water out in the channel with God's filter. The channel runs $4\frac{1}{2}$ miles an hour there, and the deep watercourse is on the Canadian side with a sand and gravel bottom. But the late John Galt, of the city of Toronto, gave us a report on our last waterworks extension, and he stood by the point where we are placing our waterworks now and he said: "There is God's filter. I do not care how impure that water meets that river from the lake, it would be purified before it would reach a quarter of the distance from where we propose to put our intake." In spite of that, we are spending money to-day to give Sarnia as pure water as we possibly can, and I think we are doing so. I only know of two cases in Sarnia hospital this year from typhoid. The patients come to our hospital from towns and townships and villages that do not use river water at all. Quite a number are sent to the hospital from the boats, who never drink a cup of Sarnia water.

Mr. GLENN. What do you do with your garbage?

Mayor DAGAN. It is collected.

Mr. GLENN. You do not dump that into the river?

Mayor DAGAN. No. We have a dumping ground and our town to-day is working out a plan for an incinerator. When we get our waterworks finished we intend connecting an incinerator plant with the waterworks plant.

Mr. TOWERS. The engineer has informed me that the cost of the present sewerage system of Sarnia is \$325,000.

**STATEMENT OF DR. SAEGER, MEDICAL HEALTH OFFICER,
MOORE TOWNSHIP.**

I live at the village of Brigdon, which is 9 miles from the St. Clair River, directly back from the village of Courtright. I am sorry the medical health officer of Courtright is not here. Courtright is a separate municipality. We have nothing to do with it, but Dr. Ferguson, the medical health officer there, has a practice all along the St. Clair River, because he lives near by, and his evidence regarding the prevalence of typhoid would be conclusive. I am sorry to say that the medical men of Moore Township do not report all the cases of typhoid that occur. In fact they report only a small proportion of them, so that the medical health officer is handicapped in that regard.

Mr. CASGRAIN. Is typhoid prevalent?

Dr. SAEGER. Yes; they have more or less typhoid along the shore of the river every year. There are quite a number of cases, but I hear of them infrequently. Some are reported to the board of health, but the majority of them we hear of only casually. There are cases occurring along the St. Clair River all the time. Back from the river it is very seldom we have typhoid.

Mr. CASGRAIN. You attribute the typhoid along the shore to the water?

Dr. SAEGER. That is the general impression. There is no system of sewerage in the township of Moore that I am aware of. The village of Brigdon has a small system, but you could hardly call it a system. They have no waterworks. They have private tanks entering into the Sydenham River that opens off down about Wallaceburg, but the amount of sewage is infinitesimal. The town of Petrolia empties its sewage into the Sydenham River or Bear Creek, which empties at the town of Wallaceburg.

Mr. CASGRAIN. Where does that flow to?

Dr. SAEGER. That flows down south and east around Walpole Island, down into Lake St. Clair.

Mr. GLENN. How do these people get their water?

Dr. SAEGER. They dip it out of the river with pails. There are a few deep wells and some shallow wells, but most of the people living within a radius of a quarter of a mile of the river bank go to the river and dip it out in pails. They find a great deal of fault to me from the discharge of the Imperial Oil Works, situated just below the town of Sarnia within the municipality, and when they dip water at Mooretown they dip out a lot of this crude oil and other refuse which they say comes from the refinery in Sarnia. There is a great deal of fault found with that.

Mr. GLENN. You can not tell whether the sewage of Sarnia contributes to it or not?

Dr. SAEGER. No.

Mr. GLENN. But you do know they have typhoid down the river, where these people use the water practically directly from the river?

Dr. SAEGER. They have more typhoid there than in any other portion of the township of Moore.

Mr. MAGRATH. How far back does the township run?

Dr. SEAGER. It is about 12 miles square; it runs for 12 miles frontage on the river, with the exception of the village of Court-right.

Mr. CASGRAIN. What percentage of the people live along the river?

Dr. SEAGER. Not more than one-fifth or one-sixth of the people who use that water.

(D. P. Shaw, reeve of the township of Moore, was then called.)

STATEMENT OF MR. D. P. SHAW, REEVE OF MOORE TOWNSHIP.

Mr. CASGRAIN. Have you any statement to make to the commission as to the supply of water to your township?

Mr. SHAW. I do not think so. I think Dr. Seager has stated all I could say. There is a sewer in the village of Brigdon which empties into the creek and finds its way into the river below Wallaceburg. I think there are a few houses along the river in Corunna and down below Courtright that have sewers from the private residences into the river.

Mr. MAGRATH. Have you any complaint to make about any person dumping raw sewage into the river?

Mr. SHAW. The complaints we have are about the discharge of the oil into the river. When the people dip the water from along the river the pail is covered with oil, and there is oil on the water as well.

Mr. GLENN. Oil is not very injurious to health, is it?

Mr. SHAW. I do not think so.

Mr. GLENN. It is bad for the taste and smell, of course.

Mr. SHAW. It is.

Mr. GLENN. Do the people living down below think it is right to pour the sewage into the river?

Mr. SHAW. They would rather think it was best not to put it in, if they would say so.

Mr. GLENN. No doubt they would rather drink water purified than water that the sewage comes into raw?

Mr. SHAW. Yes.

Dr. SEAGER. Below the village of Courtright there is one family of 5, another family of 15, and another family of 4 with private sewer systems entering into the St. Clair River. At Corunna there are four families putting their sewage into the river. At Stag Island there are 27 cottages that empty their sewage into the river. They are summer residences.

(Dr. W. H. Henderson was then called.)

STATEMENT OF DR. W. H. HENDERSON.

Mr. CASGRAIN. You have been practicing for some time here?

Dr. HENDERSON. For 15 years.

Mr. CASGRAIN. You practice in the town of Sarnia and also on the Indian reserve in the neighborhood?

Dr. HENDERSON. Yes.

Mr. CASGRAIN. What has been your experience as to typhoid in Sarnia?

Dr. HENDERSON. The Indian reservation extends down about 4 miles, and during the six years I have treated the Indians—and they all along the front dip their water, with one or two exceptions, from

the river—I can not remember a single case of typhoid in all that six years I refer to.

Mr. CASGRAIN. What about Sarnia?

Dr. HENDERSON. We have no typhoid in Sarnia.

Mr. CASGRAIN. You had an epidemic in 1911?

Dr. HENDERSON. We had quite a number of cases.

Mr. CASGRAIN. You say the city of Sarnia now is practically free from typhoid?

Dr. HENDERSON. Practically free from typhoid.

Mr. CASGRAIN. Do you know anything about the conditions lower down in the township of Moore? What is your opinion as to dumping raw sewage into a stream like the St. Clair River? Do you think as a medical man you would recommend it?

Dr. HENDERSON. That would depend on how far the river had to run before the people down below used the water for drinking purposes.

Mr. GLENN. Are the Indians as subject to typhoid as the white man?

Dr. HENDERSON. There is no difference, I think.

Mr. CASGRAIN. Are you still the physician for the Indians?

Dr. HENDERSON. No.

Mr. CASGRAIN. When did you cease to be?

Dr. HENDERSON. In 1911.

Mr. CASGRAIN. Mr. Magrath suggests to me that there was an election about that time. Are the Indians increasing in population?

Dr. HENDERSON. They are not decreasing; they are about the same. They remain about the same in number. There are about 330 of them. The reservation is 4 miles square and contains about 60,000 acres.

STATEMENT OF MR. F. A. DALLYN.

Mr. GLENN. With regard to this crude oil which floats along the water, what effect does that have on the water?

Mr. DALLYN. I can not very well answer that question without going into the question of just what part of the oil they are wasting. I was not aware there was any serious trouble, and the refineries usually recover all the by-products. I think it is probably due to carelessness in cleaning out the tanks.

Mr. GLENN. Is oil looked upon, as a general rule, as pollution?

Mr. DALLYN. It gives quite a visible pollution.

Mr. GLENN. Is it unhealthy?

Mr. DALLYN. I have never heard it mentioned as being unhealthy. Of course you would not drink it and it does not mix with the water, so that it does not affect fish life, but it kills mosquitos, and so there may be some advantage in it.

Mr. GLENN. You heard what Dr. Seager said in regard to the people who dipped the water from the river having typhoid, and that those on the inside, who do not use the river water, do not have typhoid?

Mr. DALLYN. At the time of the typhoid epidemic here in 1911 there was an investigation made by the provincial government into the matter. Dr. McCullough was the commissioner, and at that time the evidence tended to show that the people living down the river had a considerable amount of typhoid all the time, and it was attributed by the medical men who gave testimony at that time, to

the fact that they take water from the river. Of course it is rather difficult to draw a conclusion from the case of the Indians. That is a fixed population of about 300, and I imagine they have a certain amount of immunity against infections of that kind; they have other diseases that probably balance up the typhoid.

Mr. GLENN. Was there any typhoid among the Indians in 1911?

Mr. DALLYN. They were discussing the probability of typhoid being associated with the sewerage at Sarnia, and they brought in medical men from below on the river, and their opinion was that there was a considerable amount of infective matter in the sewerage.

Mr. GLENN. What conclusion did you come to as to the condition of the water below Sarnia?

Mr. DALLYN. I think possibly that Mr. Towers's position is well taken; Sarnia is not polluting the river to the extent that remedial measures are absolutely necessary. But I can not consider the question separately. It must be a whole question as to the boundary waters; I imagine that it is quite proper that Sarnia should put in treatment, and I think the city can well afford to do so.

Mr. GLENN. The treatment of their sewage would not require as extensive a treatment as some other sections differently located.

Mr. DALLYN. That would be a question of administration; I do not know how you could arrange it. It does not actually require such extensive treatment. I think that position is well taken.

I wish to state to the commission, before the meeting concludes, that Dr. McCullough has wired me, and wishes to express on behalf of the provincial board of health their appreciation of the investigation which your commission is making. This question has been up here for quite a long time, and in connection with the recent sewerage-extension work of all these municipalities, we suggested to them that your body might make recommendations as to purification measures, and, in view of that, they should see that the sewers were put in at such levels that they could be connected to make a system.

I would like to respectfully suggest that some of the conditions presented with reference to storm water have been somewhat exaggerated. The storm water, as a rule, does not amount to more than 5 per cent of the total sewerage for the year, but it is very embarrassing to deal with in the manner in which it reaches the sewers. You are liable to get thirty times your normal flow occurring inside of a few hours, which means that if you have tanks to give effect to sedimentation or chlorination they are inadequate to handle the storm flow. It is not impossible to adjust conditions as between the storm flow and the ordinary flow, but it is an embarrassment.

The question has been raised whether it is cheaper for the towns below to purify their water than for the towns above to purify their sewage. It is rather difficult to make an answer to that. There is a peculiar condition which comes in here. We design our water-works upon the recommendation of the fire underwriters, who require a certain pumping capacity. The domestic supply is usually probably not more than one-third of what the fire underwriters require. That means that if you put in filters for the domestic supply they will not take care of the fire underwriters' requirements. The fire underwriters have suggested auxiliary intakes, which are not sanitary, and upon request from our board they have ceased

doing that, and they recommend larger filter units or auxiliary reservoirs, containing pure water, but that means that the ordinary expense of water purification is multiplied by three, and the capital expenditure is the heaviest item these small towns have to bear. On actual figures three times the water purification measures amounts to about the equivalent of sewage treatment. I cite that because it is an interesting point that these small municipalities are up against.

Mr. CASGRAIN. Mr. Dallyn, we reciprocate the statement which you made to us on behalf of the provincial board of health. The Provincial Board of Health of Ontario has rendered great service to the commission. My fellow commissioners and myself will bear me out in saying to you personally, Mr. Dallyn, that you have been of great service to us.

Mr. DALLYN. I thank you.

Mr. GLENN. I indorse that.

Mr. TOWERS. What your honors ask Mr. Dallyn as to what position he takes with regard to the city of Sarnia. Would you ask him if he is satisfied that at any point the sewage from Sarnia crosses the international boundary line, to the prejudice of health or property on the other side?

Mr. DALLYN. I am afraid I would have to answer that in the way Dr. McLaughlin has answered it. It is very difficult to tell from the appearance of the colon bacillus whether he comes from Sarnia or from Port Huron.

Mr. TOWERS. That may be all right, but it is a very serious matter for us. We have spent one-quarter of a million dollars on water-works, and if you peruse our financial statement you will see that we are more to be pitied than blamed. It is a serious matter for us should the commission come to the conclusion, as Mr. Dallyn says, that it is going to be a matter for everybody, no matter what the local conditions may be, and that we must do it because others are doing it. If the commission should come to the conclusion that Sarnia does occupy a unique position and that her sewage does not cross the boundary to the detriment of the other side, then, of course, we would ask to have the benefit of that conclusion.

Mr. GLENN. It was demonstrated at Niagara Falls that where, as a general rule, the sewage from one side did not cross to the other, yet at certain times, because of severe winds or stoppage by ice, etc., these things went across which otherwise would not go across, that that being so it became an international question. It is not an international question; we have no business to deal with it.

Mr. TOWERS. If there is any question to be dealt with in that respect in relation to Sarnia, I would rather have this board deal with it than any other board I know of.

Mr. CASGRAIN. We will take into consideration all you have said, Mr. Towers, and your able presentation of the case. We make no decision in the matter ourselves. This reference to us is for our recommendation and report to the respective Governments which will deal with the question.

Mr. TOWERS. The respective Governments would no doubt consider your recommendation carefully.

The town of Petrolia, Ontario, submitted a written statement, as follows:

MAYOR'S OFFICE, PETROLIA, ONTARIO, October 15, 1914.

L. J. BURPEE, Esq.,

Secretary International Joint Commission, Ottawa, Ontario.

DEAR SIR: In complying with your suggestion that we submit in writing anything we have to say regarding the position of the town of Petrolia in connection with the pollution of boundary waters we beg to submit the following:

We have a population of 4,000 people. We get all our water supply from Lake Huron. It comes to us underground, a distance of 14 miles. Our intake pipe is 1,000 feet out into the lake. We believe we have a very good water for all purposes, although it occasionally shows the presence of bacillus coli. This, we suppose, comes from the surface drainage of pasture lands in the vicinity of the lake shore. There is no village, town, or city within many miles of our intake pipe. Perhaps the best evidence we have that we are using a fairly safe water is the fact that we have had practically no typhoid fever for 15 years. The few cases we had four years ago were traced directly to our milk supply.

Our sewerage system through the town is permeated with large quantities of chemical waste from the refineries and mineral waters, especially sodium chloride from the oil wells. Our sewers discharge into Bear Creek. This stream runs the year round, across country a distance of 32 miles. There it unites with another stream and forms the Sny Carte. This is a sluggish stream running about 20 miles before it empties into Lake St. Clair at a point several miles from the international boundary.

From the above we think you will be able to see that our connection with the pollution of international waters is very slight indeed, if any. The town of Petrolia has a record of good health. We are not aware of any town in the Province having a lower death rate per 1,000, ours being from 9 to 10 per 1,000 for the last 15 years, the rate for the Province being usually 13 to 14.

If there are any questions you would like us to answer we will be pleased to do so, as we may be able.

C. O. FAIRBANK,

R. B. MACALPINE, M. H. O.,

R. STIRRET,

Committee of Town Council Appointed to Meet Commission.

(The commission then adjourned.)

INTERNATIONAL JOINT COMMISSION,

Detroit, November 10, 1914.

The International Joint Commission met at Detroit, Mich., on Tuesday, November 10, 1914, and on Wednesday, November 11, 1914, to continue the investigation into the pollution of boundary waters. The subject dealt with by the commission on Tuesday, November 10, was as to pollution from navigation on the Lakes and connecting rivers.

Present: United States—James A. Tawney (presiding), Obadiah Gardner, R. B. Glenn, Whitehead Kluttz (secretary). Canada—Henry A. Powell, K. C., Charles A. Magrath, Lawrence J. Burpee (secretary).

REPRESENTATIVES OF NAVIGATION AND OTHER INTERESTS PRESENT.

William Livingstone, president of the Lake Carriers Association.

Francis King, counsel for the Dominion Marine Association.

J. W. Norcross, of Toronto, managing director of the Canadian Steamship Lines (Ltd.).

A. A. Wright, of Toronto, managing director of the St. Lawrence & Chicago Steam Navigation Co.

Prof. H. Sadler, of the University of Michigan.

A. W. Thompson, of Cleveland, a member of the committee of the Lake Carriers Association.

George A. Marr, of Cleveland, secretary of the Lake Carriers Association.

Ralph Williams, of Cleveland, editor of the Marine Review.

F. A. Dallyn, sanitary expert of the Board of Health for the Province of Ontario.

Edward D. Rich, sanitary engineer for the State Board of Health of Michigan.

W. H. Dittoe, sanitary engineer for the State Board of Health of Ohio.

MR. TAWNEY. The International Joint Commission is assembled here this morning, pursuant to notice that has been given to representatives of the Lake Carriers Association on both sides of the line, for the purpose of a hearing with respect to their contribution to the pollution of the boundary waters, and also with respect to such remedies as they have to suggest to prevent such pollution. In calling the commission to order, I may, for the information of the gentlemen present say that under the treaty between Canada and the United States, of date January 11, 1909, both countries have agreed that the waters which mark the boundary between them shall not be polluted to the injury of health or property on either side. In 1912 complaints were made to both Governments that this provision of the treaty was being violated, in that the waters were being polluted on both sides of the line in contravention of that provision of the treaty. Accordingly, the two Governments formulated two general questions and submitted the same to the commission, under Article IX of the treaty, for investigation and report as to our conclusions respecting the fact and extent of pollution and also the remedies that we would recommend to prevent such pollution and thus prevent further violation of this treaty.

In accordance with the request of the two Governments, the commission proceeded in 1913 with an investigation of the first branch of the reference, namely, the question of whether or not the waters were being polluted in violation of this provision of the treaty, and if so, to what extent. The commission employed thirty-odd scientists and bacteriologists in its investigation, and it installed along the border 17 laboratories, and as a result of the investigation it has found that the waters marking the boundary between Canada and the United States are being polluted, from different sources, and polluted in contravention of this provision of the treaty.

One source of pollution comes from the municipalities, and the other source comes from steamboat navigation on the lakes and connecting rivers. We have taken up now the second branch of the reference, namely, the remedy for the pollution which has been found to exist. We have already heard the cities of Detroit and Buffalo, and other cities on these boundary waters, and are meeting here to-day for the purpose of hearing the representatives of the Lake Carriers' Association for the purpose of ascertaining the facts with regard to their contribution to this pollution, and what suggestions, if any, they have to make in the way of remedies for the same. The commission desires this information before proceeding further to a final consideration of its conclusions and its answer to both Governments on the reference.

Notice has been given to Mr. Livingstone, as the representative of the Lake Carriers' Association on the United States side of the line, and to Mr. King, as the representative of the Lake Carriers on the Canadian side.

RETIREMENT OF HON. MR. CASGRAIN.

Before we hear these gentlemen I wish to call attention to the fact that since our last meeting, on the 6th of October at Ottawa, our associate, the Hon. T. Chase-Casgrain, of Montreal, has been called to the high position of a cabinet minister of the Dominion of Canada. On behalf of the commission I desire to express our sincere regret that we have lost his services on this commission, and I congratulate the Dominion Government on securing the services of a gentleman of his capacity, ability, and energy. I know that I express the opinion of every member of this commission when I say that we regret sincerely the loss of his judgment and great experience in this work in which he has always taken a very deep interest. We wish the Hon. Mr. Casgrain every success in his new career.

Before Col. Livingstone proceeds to address the meeting, it may be of some assistance to the gentlemen who wish to be heard to call attention to what is contained in the progress report of the commission with respect to the pollution of these waters by steamboat traffic on the Lakes. I presume that you gentlemen are familiar with the report to which I refer. The facts as found by the bacteriologists of the commission show that steamboats are contributing to this pollution in two ways: First, by the indiscriminate discharge of their sewage on the tracks of the vessels through the rivers and lakes, and, secondly, by taking water ballast in heavily polluted areas and discharging that ballast into less polluted areas, frequently in the vicinity of the intakes of the waterworks of the various municipalities that they pass. These are the two chief sources from which it has been found that steamboats contribute to this pollution. The extent of this pollution is estimated from the number of people who are traveling on these lakes and rivers during the navigation season, and which, according to the report, aggregated in 1912 over 15,000,000 people. I thought it might be of some assistance to direct your attention to these matters.

Mr. LIVINGSTONE. Speaking of these 15,000,000 people, I assume that that number includes all the passenger service and all the boat service between Buffalo and Duluth, at the head of the lake, and Lake Michigan ports, Chicago, and Milwaukee?

Mr. TAWNEY. Yes; the number has been taken from the official record of the Government of the United States for the year 1912.

Mr. LIVINGSTONE. I believe that is approximately correct, judging by our figures here, where we have the largest district on the Lakes. There are more passengers from Detroit and this district than from any other.

Mr. Chairman and gentlemen, I ought to say at the outset that, so far as our interests are concerned, we desire to cooperate with you in every possible reasonable way in preventing the pollution of these waters. We believe, of course, that the health of the community is paramount to any possible other interest, and that no commercial interest should stand in the way of the health of the people as a whole. But we are somewhat at a loss to determine just what you want of us. We understand, in a general way, of course, that you

have had a good many experts employed, and you have taken tests of the waters all over the Lakes in different areas, and you have that report compiled before you. This question comes up in our minds quite strongly, and I shall put these points as they occur to me. The municipalities, of course, so much greater preponderate in the percentage of the pollution of these waters that it would seem that after making your tests you should have formulated some system by which the pollution by municipalities should be controlled, and that after the municipalities have done this, it is possible we might be able to adopt a better way than we have at present and a way in which the percentage of prevention would be very much greater than were we to start in haphazard at some experiment which might end in failure. Clearly understand me that we desire to assist you in this matter, but I think I am safe in saying that 90 per cent, at least, of the pollution is caused by the sewage and pollution that comes from the municipalities.

Mr. TAWNEY. I do not know what the practice on these steamers is. Speaking for myself, I am not familiar with the practice of steamboats discharging their sewage between the different ports they ply to.

Mr. LIVINGSTONE. So far as that is concerned, or so far as my knowledge goes, on the Great Lakes all of the sewage is discharged into the water.

Mr. TAWNEY. Indiscriminately?

Mr. LIVINGSTONE. Indiscriminately, yes; I think there is no question about that.

Mr. TAWNEY. What is the practice as to taking water ballast and discharging it, and to what extent is water used for ballast in the voyage of vessels from one port to another?

Mr. LIVINGSTONE. All of the modern vessels have water-ballast tanks, and the usual mode of procedure is—many of these boats, a great many of the boats in the iron-ore trade, run up light and bring down ore. All of the boats that run up light as a rule fill their ballast tanks with water to such extent as the captain may determine, depending on the weather, and then before they get into port that water is pumped out again.

Mr. TAWNEY. The ballast tanks are filled in the harbor from the water in the harbor?

Mr. LIVINGSTONE. I think not, as a general proposition. I will not say positively, because I have not investigated that question, but I can investigate it later. I think, as a general proposition, the ballast tanks are filled, after they leave the harbor, outside. It is a simple process to fill ballast tanks, because all they have to do is to open the valve and the water rushes in. When they discharge the ballast tank the water is pumped out, and unless it is very heavy weather, so that it is necessary to keep the ballast in the boat to have her enter port safely, in the great majority of cases they start to pump that ballast out a couple of hours before they get into port, so that it is not discharged in the harbor. But, of course, that ballast water is discharged outside in the lake. I do not need to indicate that the pumping is done outside so as to prevent pollution, because these are new questions to us, but it is certainly done for the purpose of saving time. The great thing now in the business of navigation, particularly in freighting, is to save time; in other words, to make

the greatest number of trips in the least possible time, and every effort is made to save every possible moment. If they did not empty ballast tanks before they entered into port, they would be detained from one to two hours pumping it out. They start two or three hours before they get to port, and when they get to the harbor the ballast water is out, and they are ready to lie alongside the dock and get their cargo. That is so, no matter what the freight may be, whether it is ore or package freight. While I want you to clearly understand that there may be isolated cases, I am merely speaking of it as a general proposition, and the great majority of boats carrying water ballast take their water ballast after they are outside port and discharge it before they get into port.

Mr. TAWNEY. What is the practice with respect to boats taking on water for domestic use?

Mr. LIVINGSTONE. The water for domestic use comes from an entirely different set of pipes.

Mr. TAWNEY. What is the practice as to the locality from which the water is drawn for domestic purposes on board these ships? Is it taken indiscriminately, or is it the practice to take it from some area that is known to be absolutely pure, or is there any attention paid to that whatever?

Mr. LIVINGSTONE. There has been attention paid to that for some little time back, but at the same time I am free to say there is no absolute fixed rule. For instance, very few, if any—I will not say there are none—take their water from Lake Erie, but as a matter of course those which trade on Lake Erie have to use that water. But take the through boats. As a general proposition, they do not take water for drinking and other domestic purposes from Lake Erie, because there have been tests enough made of Lake Erie water to show that the water in that lake is quite badly polluted. As a protection for the general health, boat managers have given their masters instructions about that. We have made intimations in connection with it, in furtherance of our efforts in that direction. There is no fixed rule. There has been no hard and fast order issued that you must take your water in certain areas. That, of course, could be largely carried into effect. So far as my knowledge goes, with regard to our particular fleet, I think a great majority of our boats take their water as far as they possibly can from Lake Michigan and from Lake Superior. Sometimes there are boats that take water for cooking and for drinking purposes from taps on certain docks where there are these taps, and they take it with a hose. That is done in some cases.

Mr. TAWNEY. What have you to say as to the frequency of typhoid fever on board vessels?

Mr. LIVINGSTONE. We have had very few cases. I would have to ask the secretary about that, because he is more familiar with it, and in what we call our welfare plan; they keep track of that.

Mr. TAWNEY. It has been reported to the commission that last year, 1913, there was a typhoid fever epidemic on three different vessels.

Mr. LIVINGSTONE. These reports would be made to me, and I must confess I do not recall anything of that kind nor does the secretary of the Lake Carriers' Association.

Mr. TAWNEY. This information comes to the commission from the Federal Board of Health at Washington.

Mr. LIVINGSTONE. At present I can not make a statement positively as to that either one way or the other. I will simply say that it has not been brought to my knowledge, and I get these reports. May I add to that this: We have in our association a welfare plan, which is devoted entirely to the welfare of our men, and among other things in that plan—I shall be glad to furnish you with a copy of many of the suggestions in that plan—there are orders as to what they should do. We have a sanitary committee, and that sanitary committee has made quite a number of investigations concerning the cleanliness of the boats, and orders have been issued about cleaning their tanks, and about how they shall take their water in, and about the cleanliness of the kitchen, and everything appertaining to the general sanitary condition of the boats. If you have a Federal report saying there were three cases of typhoid fever, that ought to be correct.

Mr. TAWNEY. Has your association adopted any regulation with respect to the discharge of the sewage or with respect to the taking on of ballast or with respect to taking drinking water for use on board vessels?

Mr. LIVINGSTONE. We have adopted some regulation, but not to a very far-reaching extent. Do you mean as to the discharge from the wash rooms into the water; there has been no order as to that.

Mr. TAWNEY. Has your association taken any steps whatever toward restricting the discharge of water ballast in the neighborhood of the intakes of waterworks?

Mr. LIVINGSTONE. No, sir.

Mr. TAWNEY. Is it or is not true that many of the vessels use the intakes of waterworks of the different cities, as they come into harbor, for the purpose of guiding them?

Mr. LIVINGSTONE. I think that may be so to some extent, but not as a general proposition, because all the harbors are so well lighted and have so many ranges that it is not necessary. There are some harbors where the intake pipe and pier are out a good way, and they might use it as one of the aids, but it is not necessary that they should.

Mr. TAWNEY. From your knowledge of the lake traffic, especially on passenger boats, what can you say as to the general use of closets on board vessels before the vessels come into port?

Mr. LIVINGSTONE. I can not say as to that. So far as our boats are concerned, I can not see why that should be so.

Mr. TAWNEY. It is almost a natural condition, and it would occasion considerable more pollution near the intake of the waterworks than would otherwise exist.

Mr. LIVINGSTONE. I am not disposed to agree with that. I do not think that is so. As a general proposition I do not think it is so, and I do not think it occurs in the neighborhood of intakes. Last summer our water board in Detroit wrote to me, and I had a conference with them relative to the intake point at the Detroit River that is on the American side, and is up near the head of the island. I happened to be out of town when your commission was here in connection with the question of municipal pollution of the water, some little time ago, and so I was not able to be present. The result was that the Detroit water board made a request to us that we should instruct the down-bound boats—because, of course, the up-bound boats would be below the current—they asked us to make some kind of regulation or in other words to give instructions to the masters

not to discharge anything that would create pollution of any kind, within 4 or 5 miles of the intake on Lake St. Clair. I got out a bulletin instructing the masters—of course, we can only control our own fleet—that they were not to discharge any offal or anything else of that kind within 5 miles of the mouth of the intake. I can not speak for passenger interests, but I know they agreed to do it, and I assume it was carried out.

Mr. TAWNEY. What is the average number of the crew on each of those boats?

Mr. LIVINGSTONE. We have no passenger boats. We have 460 boats, and the crew would run from 18 to 25 and in some cases 26.

Mr. TAWNEY. From your knowledge of passenger boats, what is the usual number of the crew on a passenger boat?

Mr. LIVINGSTONE. The crew on passenger boats would vary according to the size of the boats. We have some boats that might carry 3,000 passengers. But that particular boat I refer to goes to Port Huron and makes the round trip in a day. We have a number of boats also that run above the flats, where the clubhouses are, during the height of the passenger season. The passenger boats running to Port Huron run until the season closes, but they take off the large boats about the first of October when it gets cold.

Mr. TAWNEY. How many through passenger boats are there from Duluth to Buffalo?

Mr. LIVINGSTONE. The Anchor Line has four package freighters and passenger boats combined, and there are the Northland and Westland, which they call the Jim Hill boats.

Mr. TAWNEY. What is their capacity?

Mr. LIVINGSTONE. I do not know positively, but I should think that if they had 600 passengers that would be about all they could take out.

Mr. TAWNEY. What number of boats pass up and down the Detroit River during the navigation season?

Mr. LIVINGSTONE. I will be able to give you figures as to that later.

Mr. TAWNEY. Do these vessels all follow the same channel?

Mr. LIVINGSTONE. Practically so. We have been trying to run in lanes, and we have issued orders to that effect, so far as we possibly can, in the same way as on the ocean. The up-bound boats will take one lane and the down-bound boats another lane, but I do not think that has any bearing on the question of pollution.

Mr. TAWNEY. My recollection is that there is one vessel up and down the Detroit River about every 13½ minutes during the season of navigation.

Mr. LIVINGSTONE. We keep a record of the number of vessels passing up and down the Limekiln Crossing. We have a man on duty night and day, and we get a report of every boat that passes up and down, including the little pleasure boats as well as the large steamboats.

Mr. TAWNEY. Does that record include the excursion boats running from here to Windsor?

Mr. LIVINGSTONE. Our report does not include any of the ferries crossing from Detroit to Windsor, nor from Detroit to Walkerville, nor does it include the pleasure boats that run up and down between Belle Isle and Detroit. Our records for the season of 1913, from April 17 to December 15—a period of 242 days—show that 13,692 vessels passed the Limekiln Crossing and 10,089 used the Livingstone Channel—that number wants to be added, as I shall explain—giving

a total of 23,781 vessels, which is an average of one vessel every 14½ minutes. That is for the entire 24 hours of the day for these 242 days. This, of course, you understand, does not include the sand scows and tugs that work on the improvements in that vicinity. The largest number of vessels passing through the Detroit River in 1913 was on July 4, when 162 vessels passed, east and west bound. The up-bound vessels take the Amherstburgh Channel and the down-bound boats take the Livingstone Channel. The two channels are entirely separate. Of course, if there was any refuse deposited in the Livingstone Channel it would go out into Lake Erie.

Mr. MAGRATH. Have you had any accidents at the entrance to the Livingstone Channel this year?

Mr. LIVINGSTONE. Comparatively few. We have had very few in fact, and while I would not make the statement as being accurate, in almost every instance what little damage we have had down there, and it has been comparatively small, has been due to defective steering gear, something giving way, or something of that kind. We have had no loss of life or anything of that kind, and the loss altogether did not amount to much. We had one boat that made a mistake going down; instead of keeping to the proper side at the entrance of the Livingstone Channel it got too far down, and he ran across Rocky Point, where your Government is about to erect a light; that is, in the intersection that divides the east and west channel.

Mr. TAWNEY. The dike which this commission recommended should be constructed on the west side of the Livingstone Channel is not yet completed?

Mr. LIVINGSTONE. No, sir; it has not been constructed yet.

Mr. TAWNEY. So that the cross currents that were feared at that time are still in existence?

Mr. LIVINGSTONE. Yes; and at some times they are a little worse than others, but the currents are still there. With all due deference to the commission, I think still that the dike should go on the east side. The passengers carried in the Detroit district last year, that is, Capt. Westcott's supervising district, numbered 10,026,545.

Mr. TAWNEY. What comprises the Detroit district?

Mr. LIVINGSTONE. I have not the exact metes and bounds.

Mr. TAWNEY. In a general way, what does it include?

Mr. LIVINGSTONE. The eighth district extends from Lake Erie to Duluth and also takes in Lake Michigan, Chicago, Milwaukee, and Grand Haven, and those harbors. Those are the passengers that have been carried from the various points. I should not have said the "Detroit district"; I should have said "Detroit" and left the word "district" out. The district over which Inspector Westcott is supervising inspector runs from Bar Point clear to Duluth, and it also takes in Lake Michigan. The following table shows the number of passengers:

1913:

Detroit.....	10, 026, 545
Chicago.....	1, 481, 920
Duluth.....	271, 715
Grand Haven.....	402, 176
Marquette.....	66, 624
Milwaukee.....	193, 501
Port Huron.....	642, 253

Total..... 13, 084, 764

I presume they would group in Port Huron the little river towns, and that gives a total of 13,084,764, and of course you would have to add to that the Lake Erie district below Bar Point, which would take in Buffalo and Cleveland, and that would make the fifteen millions you referred to.

Mr. TAWNEY. The fifteen millions I referred to was for 1912, according to the official record. The number of passengers in 1913 would be greater than in 1912, because Buffalo and Cleveland and the cities below Bar Point would more than equal the difference between the official figures and your figures for Detroit.

Mr. LIVINGSTONE. They would have to be added to the figures I have given. These figures do not take in the points all the way down the river to Buffalo.

Mr. TAWNEY. And these are only the passengers on the American side?

Mr. LIVINGSTONE. Yes.

Mr. TAWNEY. So that the passengers on the Canadian side would have to be added to those figures?

Mr. LIVINGSTONE. Yes.

Mr. TAWNEY. And that would materially increase the aggregate?

Mr. LIVINGSTONE. Yes. We have no record of the figures for the passengers on the Canadian side. This represents the passengers on the American side. The figures I have given you are for the district in charge of the supervising inspector of this district. There is quite a passenger traffic that runs into the Georgian Bay and Port Arthur and up through all these Canadian points; there are quite a number of excursion steamers that run in through there.

Mr. TAWNEY. Has your association ever considered the matter of disposing the raw sewage in some other way than the indiscriminate disposal of it in the waters through which your vessels pass?

Mr. LIVINGSTONE. It has been discussed, but only in a tentative way; no positive steps have been taken in connection with it.

Mr. TAWNEY. Has there been any experimenting with respect to the disposal or sterilization of sewage on board the vessels?

Mr. LIVINGSTONE. No positive steps have been taken in that direction. The actual steps that have been taken have been to give instructions about a year ago relative to sanitary conditions, and so forth, on board the boats. I could file that with you for your information. May I say one thing in connection with that? You spoke about the pollution that may occur from carrying water ballast, taking the water in at Buffalo Harbor, which may be polluted, and carrying it to Duluth and depositing it in Duluth Harbor, to the menace of health. While I do not think that prevails, and in fact I am positive that it can only prevail to a very limited extent, yet so far as that is concerned we would be very glad indeed if after you get through with your investigation you decide at what distance out we should take our water ballast and where we should discharge it, and we would be glad to comply with it as far as we can.

Mr. TAWNEY. What would be the attitude of the Lake Carriers Association toward international regulations governing the matter of taking in water ballast and discharging the same, and also the matter of disposing of sewage on board vessels, and the matter of regulations governing the taking on of water for drinking purposes on board the vessel? In other words, what would be the attitude of your association toward general international regulations for the purpose

of preventing pollution and also protecting the public health on board vessels, as well as protecting the public health on shore?

Mr. LIVINGSTONE. We would be entirely friendly to that, and we would be ready to go to any reasonable limit to help accomplish it. It is possible there might be something laid down which would be extremely drastic and with which we could not comply, but as a general proposition we would be very friendly to it and would do everything in our power to cooperate in carrying it out. We are, of course, very much interested in the health of the men who work for us, and in the health of the public generally; we are vitally interested in that matter ourselves.

Mr. TAWNEY. Your association would be willing to assist the Government in enforcing and carrying out such regulations?

Mr. LIVINGSTONE. Yes, sir; so far as we possibly could. You must bear in mind, however, that there are some things in this respect which you can do ashore which you can not do on board the boats.

Mr. TAWNEY. The result of this whole thing will be to remedy the evil both on shore and on the water. Now, Col. Livingstone, would you give the commission your idea of the extent to which your organization and the masters of the vessels are willing to go in the matter of remedying the pollution, which is contributed to at the present time by these vessels?

Mr. LIVINGSTONE. That is a pretty difficult question, and I can only answer it in a general way and as nearly as I can. You will understand that a great many of these propositions are somewhat new. I think we have this sort of a feeling—as I have already said we will cooperate with you in every possible way within the bounds of reason—but we have this feeling—perhaps that is the best way to express it—we have this feeling that there are a good many things to be considered in connection with this proposition. Now, for instance, supposing it was decided that we should carry tanks on board for taking care of this sewage until we have reached certain areas at which it could be discharged, we had the feeling that what would be the best method and what would be the best tank to use is something that should be decided upon by the Government through their experts. These experts have more and better opportunities than ordinary outside laymen to determine just what kind of tank that should be, and as to how the modus operandi of it should be conducted. These experts of the Government have their laboratories and everything at hand to test what would be the best method; they can make experiments as to whether we should use live steam or not, and so on. All these things involve more or less expense, and unless the Government makes the regulations with regard to the matter there certainly will not be uniformity and there may be failure. In other words, the Government should be satisfied in their own mind that the tank they prescribe will carry out the purpose for which it was designed.

Mr. TAWNEY. The two Governments are endeavoring through this commission to find out what should be done as to pollution, both on land and on water, and it is through this commission they are seeking recommendations. We are here for the purpose of finding out if possible the extent to which the vessel owners or the Lake Carriers' Association are willing to go in cooperating with the two Governments in order to attain that end.

Mr. LIVINGSTONE. As I have already said, we are exceedingly friendly to the idea, and we will cooperate with you to any reasonable extent we can.

Mr. TAWNEY. You said you hoped the two Governments would formulate some plan and that is what the two Governments are attempting to do through this commission, and we are anxious to know what your view is.

Mr. LIVINGSTONE. The point I wish to make there is this: That while we are willing and anxious to cooperate with you in every way, and ready to go to any reasonable expense in connection with the matter, we want to have the best experience and the best talent applied to these things, so that when we start in to make any changes that will be required—we will say by instructions from the two Governments cooperating internationally—we will have what will accomplish the result sought. The point I wanted to make was that we do not want to start in in a hurry and put in a lot of stuff and afterwards find that it does not accomplish the purpose, and then we would have to throw it out and put in something else, and so largely increase the expense.

Mr. TAWNEY. Are you aware that the Public Health Service of the United States has been for some time experimenting with sterilization tanks. I understand that one was installed late this summer for the purpose of demonstrating the practicability of sterilizing sewage on board vessels before discharging it into the water?

Mr. LIVINGSTONE. That I did not know.

Mr. TAWNEY. I thought you were aware of it. We are also informed that that plan, if it works out practically, will be very inexpensive to the vessel owners.

Mr. GLENN. Is it practical to treat the sewage on some of these vessels?

Mr. LIVINGSTONE. Within certain limits, yes; I would not want to say there was no limitation.

Mr. GLENN. Could you not treat it by fine screening and sterilization before emptying it into the water?

Mr. LIVINGSTONE. I think it could be done. I was not raising any objection to that, but the point I want to make is that we should have the right thing when we start.

Mr. GLENN. You say that 90 per cent of the pollution comes from the municipalities, and about 10 per cent from your vessels; is it practical for each vessel to so treat its sewage as to empty it into the water, to all intents and purposes practically pure, so as not to pollute the water?

Mr. LIVINGSTONE. I can not answer that question; I would prefer that you would take some expert's opinion on that. Perhaps Prof. Sadler may be able to give you information on that point.

Mr. GLENN. Have you ever estimated what you could do in that line?

Mr. LIVINGSTONE. We have not.

Mr. GLENN. You never have treated the sewage on the boat in any way?

Mr. LIVINGSTONE. No, sir; we commenced about a year ago to break the edges by making some sanitary rules as to how boats should be examined, how the water should be used, and how the kitchen should be run, and everything of that kind.

Mr. POWELL. In order to insure as great immunity as possible from pollution, have you any rules in regard to the navigation of the vessels; that upgoing vessels shall pursue one track and returning vessels another track?

Mr. LIVINGSTONE. Oh, yes; we have the lane system, which I have spoken of, but of course you can not make that obligatory. We could not enforce it absolutely, because there are some boats that run straight through from the Erie ports to Duluth and they go straight to the head of the lake, and we can govern them so far as our own association is concerned, but you can clearly understand that we can not make rules that will govern people outside. Then, there are always a number of boats that do not go through; some go to Lake Michigan, for instance, and they cross these lanes. There are quite a few angles to it. The rule I refer to is not an absolute governing rule.

Mr. POWELL. On the Atlantic there is no obligation imposed on shipping by the Government as to certain lanes, but it is an arrangement between the shipping companies themselves for the safety of their vessels.

Mr. LIVINGSTONE. The Government, through the lakes surveys, survey the channels, and the charts show the different courses that should be taken.

Mr. POWELL. My purpose would be served by finding out whether or not, as a matter of practice—I do not care whether there is any obligation of not—whether as a matter of fact the vessels going follow one track, or zone, or path, or lane, and the vessels returning, as a general thing, follow another to avoid collision.

Mr. LIVINGSTONE. Yes; I think that is true.

Mr. POWELL. That would have an effect on pollution from a sanitary point of view.

Mr. LIVINGSTONE. I see the point.

Mr. POWELL. Furthermore, your organization recognizes the fact that there is quite a marked pollution in these lanes by the vessels; I suppose that is recognized?

Mr. LIVINGSTONE. If they all followed these lanes there would be. I agree with you in the abstract that as a general proposition boats running from certain points to certain points do follow to a large extent the same track, and that, necessarily, confined within these particular lanes, the pollution would be greater than it would be outside, because, of course, it would be confined within these boundary limits. Naturally the master of a vessel is going to take the safest and shortest course he can, and he is going to adhere to it.

Mr. POWELL. Take the Mississippi, where there is a great deal of river traffic, and where water is drawn from the river, I suppose. Have you looked into the practice of the boats there?

Mr. LIVINGSTONE. I do not know anything about it. I was not aware that the traffic on the Mississippi was comparable with ours.

Mr. POWELL. It is not comparable.

Mr. LIVINGSTONE. If I am not mistaken, you take from St. Louis down to the mouth of the Mississippi and six of our large-class boats would carry more freight than goes down there through the whole year.

Mr. POWELL. That is true, but if they have taken steps there, then a fortiori you should take steps here.

Mr. LIVINGSTONE. You asked me if they had regulations on the Mississippi and I said I do not know. May I ask you if they have?

Mr. POWELL. I do not know. I was asking you for the information.

Mr. GARDNER. You stated that probably 90 per cent of the pollution comes from the municipalities?

Mr. LIVINGSTONE. Yes, sir; I believe that to be so. I have not figured it out accurately, but I think it is approximately right.

Mr. GARDNER. Why do a certain number of people traveling by water pollute that water so much less than a like number of people living on shore? You say you carried fifteen millions of people on these vessels between United States ports, and that would be a very large percentage of the population living on the shore of these lakes.

Mr. LIVINGSTONE. I do not believe they would pollute the water less than they do on shore if there was the same number living on the water permanently, but you have to take into consideration certain facts. You take 15,000,000 people traveling on steamers and they would not pollute the water to anything like the same extent as the same number in a municipality, because the time they are on board the boat is comparatively short. If you figure out the various trips on the Lakes and the length of time it takes to make these trips, you will find that the passengers are a comparatively short time on the boats as compared with persons living day and night in a municipality. To illustrate, on the Detroit River there is any quantity of boats passing during the summer season—we will say it lasts about three and a half months—from Detroit to the island down here, which is a favorite resort. It takes an hour to run down and an hour to come back, which is two hours, and the people go down and stay there all day, but they are only on board the boat two hours out of the whole day. Take the boats, for instance, going up the river, which are not included in the number of passengers I have given; take the thousands of people that go to Belle Isle, and they start from the foot of Woodward Avenue, and it is not quite a 3-mile run, and the thousands of passengers carried on that run make the run in 20 minutes, including the stop they make at the foot of Compeau Island.

Mr. POWELL. Is not this the point, that you are not comparing similar things? When you speak about the marine population you are speaking about the number that are carried through the season, and there is not one day that there are 15,000,000 people or one-fiftieth part of that number on the Lakes, and you may be counting one passenger 20 times, whereas in the case of the municipalities you have a fixed population there day after day.

Mr. LIVINGSTONE. I have not made the calculation, but I have the impression, in round numbers, that you will find, if you take these 15,000,000 passengers, and you take the whole pollution that there is on the Lakes that comes from these 15,000,000, it would not exceed that of a municipality that had a population of approximately 40,000. We do not say for a minute that we do not contribute a certain percentage of the pollution, but that percentage, as compared with the pollution caused by the municipalities, is a very small amount indeed. Further than that, there is the question in my mind, as I deal entirely with bulk freighters, that naturally if you take a boat carrying a crew of from 18 to 25 or 26 men, the danger from

her would not be anything nearly as great as from a boat carrying 3,000 passengers on a trip several times a day.

Mr. POWELL. As an illustration, we will say that the steamers passing up and down here are equivalent to or aggregate an average of one steamer of 3,500 tons every 13 minutes. That would be substantially 5 steamers to the hour or 120 steamers to the day, and very probably the crews of these steamers would not amount to 3,000 men. That is the population that is moving by the city of Detroit in a day, and the city of Detroit is pouring in sewage from 750,000 people as against 3,000. We are not comparing the same things at all when we talk of the population on the steamers and the fixed population of municipalities.

Mr. MAGRATH. I wish to ask you a question, Mr. Livingstone, which has no bearing on the matter before the commission to-day, but on which I would like to hear you make a brief statement. Recognizing the tremendous part played by these waters in the commerce of the two countries, may I ask you if the navigation conditions in these channels, as to the matter of lighting, the depth of the channel, the rules of the road, and so on, are satisfactory. I do not wish to take up too much time on this question, but it is a matter of interest to me.

Mr. LIVINGSTONE. Would you repeat the latter part of that question?

Mr. MAGRATH. Recognizing the tremendous value of these waters, in connection with the commerce of the two countries, are navigation conditions fairly satisfactory?

Mr. LIVINGSTONE. I am glad you asked that question, and I want to have the answer absolutely and positively recorded just as I state it. There is nothing that money can buy that is not put on all of our boats, both bulk freighters and passenger ships, and there is no improvement up to date that we do not put on. The question of expense does not cut any figure with us. The only question that comes up in our mind and that decides it, is, Will the improvement which is added accomplish the purpose aimed at in the most efficient way? You can go on board any of our boats, either passenger or freights, and you will find there is no modern idea that we have not applied. This question of sterilization tanks on board boats, while not a new proposition, has never been put into practical use, and so we can not vouch for it.

Mr. TAWNEY. I want to put this statement on the record in connection with your testimony, Col. Livingstone. At a hearing in New York City, all these eminent sanitary engineers, three from each side of the line, one of whom is Prof. Phelps of the Federal Health Service of the United States—

Mr. LIVINGSTONE. I know him.

Mr. TAWNEY. He is a recognized authority on sanitary engineering. Speaking of this pollution by vessels, he said:

Mr. PHELPS. In the first place, those vessels constitute moving sewers. They are constantly going up and down by the intakes of the water supplies, and they throw, or may throw, at any moment a rather excessive burden upon that particular portion of water going through. With regard to one another, I think the vessels would have to be considered. I have been looking into this matter and happen to know from correspondence that those lake captains object very seriously to taking water from shore, and one can hardly blame them, since the water from the center of the lake is certainly better than the water at the Chicago intake. As they travel in lanes, they may at any time seriously pollute one another's water supply. I have been working upon reme-

dies for this situation, and perhaps my feeling is engendered by the belief that we have a satisfactory remedy.

Mr. POWELL. What is that remedy?

Mr. PHELPS. A sterilization plant, operated by steam, which is entirely automatic and can be relied upon. We are trying it out experimentally and hope to place it upon one of the boats this summer. If that remedy works out, as I believe it will, it will be so simple and will satisfy these particular requirements so well and at so little cost that I believe it should be adopted without question.

I want that statement to go into the record in connection with your testimony.

Mr. LIVINGSTONE. That would be subject to some qualification. We will give you one boat, or two boats, or three or four boats, if you so desire, if you want to put a tank on board and test it out. We will help you in every possible way. Take New York Harbor as an illustration, and look at the number of harbor boats that are running there.

Mr. TAWNEY. That is salt water, and it is not used for domestic and sanitary purposes.

Mr. LIVINGSTONE. Quite true.

Mr. TAWNEY. The Sanitary Board of New York is now wrestling with that proposition from the standpoint of removing the nuisance, and dealing with it altogether in that respect and not with regard to public health.

Mr. LIVINGSTONE. Then let us get into the fresh water, and let us take all the towns on the different lakes, and you will find there are a lot of yachts and pleasure boats and little traders that keep inshore there, and I think, as a matter of fact, they are more dangerous than the through boats. They go into a great many places where the larger boats can not go, and they must pollute the water. The question in my mind is whether there ought not to be some differentiation as to the trade a boat is in, because the Government now makes that differentiation with respect to certain conditions. As I say, we shall be very glad indeed, if you want to make any tests, to furnish you with the boats, and we will help you in every possible way. Clearly understand that we want to cooperate with you and that we are not opposing anything that is reasonable.

Mr. MAGRATH. You did not answer my question, as you did not understand it. My question was directed with the idea of finding out from you if the two Governments were doing everything to facilitate navigation so as to give the very best results in conducting the internal commerce of the two countries. I referred to the depth of the channel, the lights, the rules of the road. Generally speaking, are they satisfactory?

Mr. LIVINGSTONE. Yes, sir; but you will understand that in the process of evolution and the great growth of the commerce of the country we are progressing all the time, and what we are satisfied with to-day may be out of date to-morrow.

STATEMENT OF MR. FRANCIS KING, REPRESENTING THE DOMINION MARINE ASSOCIATION.

Mr. KING. Mr. Chairman and gentlemen, I am extremely diffident about making any statement whatever, because I realize that the question is one which the commission is approaching in a very serious frame of mind, looking for information of a technical and expert

character, and anything that I may say will be of a very general nature. I would prefer to leave to gentlemen who are with me the answering of questions with regard to the actual working out on board ship of any sewerage system that may be in the mind of the commission.

The CHAIRMAN. Before you proceed, Mr. King, it would be of interest and somewhat necessary to know what the physical conditions are on your side with respect to the number of vessels along the same line that Mr. Livingstone testified to, if you have that information.

Mr. KING. Will you allow me, sir, to make just one general statement as to the attitude of the Dominion Marine Association? Upon the receipt of the notification to appear before this commission there was a great deal of doubt as to what that would be if we came here or just what benefit would arise from the discussion, but we felt that the commission was in earnest in the matter; that there is pollution; and it is the duty of the association of navigators on each side to do everything possible to uphold the hands of the commission. I must say also that it is the unanimous opinion of vessel owners on our side of the line, expressed at more than one meeting which we have held, that they must do everything possible to lay all available information before the commission; but they feel that at the present stage in anything done by way of imposing restrictions upon vessels the benefit to be derived would not be commensurate with the expense involved, and that such benefit would be practically nothing.

I think Mr. Livingstone has rather inadvertently left in the minds of the commission a suggestion of an admission on the part of vessel owners that they are guilty to the extent of 10 per cent. I think his real expression was that the municipalities are guilty of 90 per cent of the damage, using the words "90 per cent" by and large and without tying himself down to any specific figures. I am perfectly satisfied that a fair investigation and comparison of the figures that have been mentioned to the commission would show that we are more likely guilty of one-third of 1 per cent or one-fifth of 1 per cent instead of 10 per cent.

May I refer to the fifteen million that has been spoken of? Of that number of people we may assume that a great majority of them have been on the boat for only a few hours. Granting that those people have been on for a day, to find what size municipality or town would do the same damage in the way of polluting the water one must divide the fifteen million by 365 days. These passengers at the outside limit have been on one day. That would bring us down to the figure mentioned by Mr. Livingstone, that a municipality of 40,000 would do as much harm as one of those vessels. That does not give a fair idea, because those vessels are traveling through open water, and sanitary experts tell us that sewage from the ships would do comparatively little harm as compared with that which is deposited in a harbor, and you have to reduce his figure eventually lower than I have mentioned. Take the figures mentioned by Mr. Powell of the number of ships passing down the Detroit River and analyze them. How many actually deposited sewage and how much sewage was deposited? It is not the 3,000 men depositing sewage in the Detroit River opposite Detroit. It is a very, very small fraction of that number. I just hope the commission will consider that proposition

carefully. We say that if that is so and if we have millions and millions, six, seven, or eight, or whatever it may be, along the shores of the Lakes now sending the whole of their sewage into the waters, the harm done by vessels in any one of those harbors—and we must refer to the congested areas shown by the commission's progress report—is so infinitely small in comparison that to impose at the present time upon vessel owners an obligation to install expensive systems would scarcely be fair. Something must be done, and we must hasten to do it when the Governments agree what is best to be done, but the vessel owners are contributing such a small proportion of the damage that the remedy might be applied to the vessels at a later stage than at present. Of course, I realize that the commission is merely discussing ways and means.

The CHAIRMAN. In that connection, Mr. King, let me ask you if it is not a fact that during the navigation season it frequently happens that there is serious congestion of vessels above and below the locks of the Soo and that this congestion of the sewage which is deposited above the locks is a positive menace to the health of the people both at the Michigan Soo and the Canadian Soo?

Mr. KING. I do not know where the people at the Soo take their water supply.

The CHAIRMAN. They take it from the Canadian side, just above the head gate of the lock on that side. My information is and our report shows that the waters of the Canadian Soo are seriously contaminated, and there is no sewage from any municipality above deposited in the lake, except that deposited by the vessels themselves. I speak of this only to call the matter to your attention. Your statement was very broad and very general, and did not apply to specific cases.

Mr. KING. I did not intend it to apply to specific cases. I know there are a number of cases where vessels in Montreal Harbor, for instance, would accumulate to a considerable degree, and where they would deposit a large amount of sewage, but very much less than would be deposited by a municipality. You have mentioned one case, that of Sault Ste. Marie. There is a suggested answer, and that is that the intake pipe at Sault Ste. Marie is not at an advisable place and that it might be extended a very slight distance out to get away from the very rapid water and away from the head of the lock. But I think, Mr. Chairman, it would be a mistake if we were to take up specific cases, because there is an answer to every one of them, and I realize that what the commission desires at the present moment is information so far as we can give it.

Mr. GLENN. Could not that be fixed by regulation to a certain extent? Could they not be prevented from taking ballast water, for instance, except at a certain distance out in the lake, and also prevented from emptying that water in port?

Mr. KING. I agree with Mr. Livingstone to a large extent. He suggested that the vessel owners would cheerfully welcome any regulation as to the taking in and discharge of ballast water. I think those regulations would have to be designed with a chief regard to the safety of the vessels, because it is not always possible to fill your tanks after you leave port.

Mr. POWELL. That depends on the weather conditions when they are leaving port?

Mr. KING. Yes; and the vessel would have to be down to proper ballast trim.

Mr. POWELL. The rough weather, for instance, that calls for ballast in the center of the lake would call for it as the boat merged into the lake and before going into the lake.

Mr. MAGRATH. You hold that the pollution is infinitesimal from the steamers operating on the Lakes. Would not a great deal depend on where you take on your water supply—that is, whether you take it above or below an intake?

Mr. KING. Do you mean the water supply for the vessel?

Mr. MAGRATH. Yes; for ballast or for other purposes.

Mr. KING. I think as a general rule their water supply is taken in from good clear open water.

Mr. MAGRATH. Are you speaking now of water for ballast purposes?

Mr. KING. No; for purposes of drinking and washing on vessels. I know they try to get it from the middle of Lake Superior or the middle of Lake Huron.

Mr. POWELL. You may not be aware of the fact that investigations made by our experts reveal the fact that in these lanes the water is so polluted that it is not in its raw condition fit for drinking purposes.

Mr. KING. I think I had that statement from you yourself, Mr. Powell, on the train not very long ago, and I looked at one or two of the charts in the progress report. I took particular notice of the conditions only with reference to my own town of Kingston. It showed that there was no indication of dangerous pollution in any of the areas from which we take our water.

Mr. POWELL. Dr. McLaughlin has given that information in his evidence.

Mr. KING. Were you referring to Lake Huron?

Mr. POWELL. Yes; to Lake Huron.

Mr. KING. The published charts in the progress report indicate the number of colon bacilli per hundred cubic centimeters. The chart does not indicate such a condition.

Mr. POWELL. I think you are right that there is no chart indicating it, but it is a fact, nevertheless.

Mr. KING. I think is goes without saying that an area could be found in one of the larger lakes where there would be practically no danger.

Mr. POWELL. The area could be found, but it is the lane that the vessel sails in, and from which it gets its water supply, that is dangerous.

Mr. KING. I mean without deviating from the lane. It is one thing to say that a vessel passes every 14 minutes in the lake and another thing to say that it passes over any given point.

Mr. POWELL. I am simply basing my remark on the statement made by our expert, who testified that in these lanes the water was so polluted by the steamboats that it was not a fit water to drink.

Mr. KING. Did he go that far, or did he say it was perceptible? I can not answer the question because I would like to have a conversation with him to see how far it went.

Mr. POWELL. That does not mean at all times in all places in that lane the water is unfit to drink, but in that lane samples were taken which showed the water to be unfit for drinking purposes.

Mr. KING. I would like to have an opportunity, not to cross-examine, but to have a little talk for the benefit of the commission with the expert in question.

Mr. GLENN. Your talk would do us as much good as it would him.

Mr. KING. I mean to elicit from him the qualifying statement which would throw a different light upon the bald statement of Mr. Powell.

Mr. GLENN. You do not mean to convey the idea, do you, that the pollution from the vessels is so small that it does not require some kind of treatment?

Mr. KING. No, sir. I think I am not going too far in saying that the vessel owners ought to submit to any regulations that may be devised consistent with the safety of the ship.

Mr. GLENN. Have your people evolved any plans that would be beneficial?

Mr. KING. That brings me to the second point that I want to emphasize very strongly to the commission, and that is that at this stage it is absolutely impossible for us, and it would be impossible for the best experts of the country, to devise a plan which we could lay before the commission that ought to be adopted. It requires the most serious consideration, and I urge that the tests suggested by Col. Livingstone be made, if not by the respective governments, then by this commission, which is empowered to accept the offer of one or the other associations for a test boat upon which investigations could be made.

Mr. GLENN. You mean that the experiments should be made under the supervision of the commission itself so as to insure their being properly conducted?

Mr. KING. Yes; I think we would welcome that, and I think that only in that way would they be properly conducted, because if we were to report that we installed on two or three of our vessels a certain aseptic tank, we would have no possible information that that was operated in the way that the commission contemplated. In the course of the experiment we would have so many difficulties to encounter in the use of the steam that the test would not be of any material value, and I think, if I may make the suggestion without discussing the matter with the people from Canada, that if the commission would accept the proposal made by Col. Livingstone it would be very satisfactory. It is a test that may be carried out for a year or two before anyone would know what is the cheapest tank and the one that would cause the least trouble. It is not a matter of putting in one tank. If you take one of the large freighters of the lake there must be a tank installed up forward and one back of the hold. Some of the vessels are so arranged that the various water-closets run out through one common outlet at one end and one common outlet at the other end. I think there are cases where you would have to install three or four tanks.

Mr. GLENN. Would that be absolutely necessary?

Mr. KING. Not if you could get the drainage that is absolutely necessary, and that has been found to be necessary from the smallest yacht to the biggest steamer, the complete flushing system. But that is, of course, a matter that I can not attempt to speak of. It is a matter for expert experimentation.

Mr. GLENN. What can you say about the practice with respect to taking water aboard for drinking purposes? Is it the practice to take

it indiscriminately or at certain given points? Is there any regulation with regard to that?

Mr. KING. There is no positive regulation, but I know from experience, in certain cases with which I have had connection, that every effort is made to take it from the best available source, either from one of the supplies in the ports that the boat reaches or from open water.

Mr. GLENN. Is it not a fact that the person on board the vessel who performs that duty is usually some roustabout or some employee who is indifferent as to whether the water is taken from a pure area of a polluted area?

Mr. KING. Yes; but on most of the vessels now we have good regulations and that roustabout is subject to such regulation that he is going to comply fully. The rule is broken, but the rule is there, and they try to carry it out. It was found in one case that the water tanks were being contaminated by ice. For instance, the meat supply may have been kept in cold storage by ice that was gotten from a poor place, and the boat might dump that into the water tank from which the people drank, but that is an exceptional case. I think regulations devised by the commission would be welcomed on that point. It is a thing that can be carried out regularly and easily, and we would welcome anything of that kind.

Mr. MAGRATH. You are not governed by provincial regulations?

Mr. KING. I do not think they touch on that point. I am not sure that they do.

The CHAIRMAN. I presume that the regulations on both sides relate more peculiarly to the matter of navigation than to sanitation.

Mr. KING. Yes; so far as they do touch the vessel at all. The question of Mr. Magrath has suggested something else to my mind. I am not quite so cheerful as Mr. Livingstone was as to the situation from end to end of the line. I do not want to make any specific complaints unless they are invited, but we are always open for improvement in a number of respects. You mentioned the rules for the road. The rules on both sides are not in uniformity at the present time. I understand that the Canadian Government is deferring action until they can by treaty with the United States devise a general system, including the rules of the road, that will be uniform from end to end of the line, and we shall welcome the day when there is uniformity.

I do not know whether the canals of the Dominion are expressly under the jurisdiction of this commission or not, but I would like to seize the opportunity to suggest that they were primarily devised for navigation and that a secondary use is that of power, whereas the fact is that the use of canal water for power purposes is seriously prejudicing navigation interests, and that time and again the vessels of the Canadian fleet have been held up in the St. Marys this year because the water was being used for power purposes. I am not complaining against any particular official of any department or any responsible head of any department. It is a very serious complaint, however, and it is one that we propose to make in the proper quarter.

The CHAIRMAN. You spoke of the Dominion Government contemplating certain action by treaty. You meant the Governments of Canada and the United States, of course. Could not the matter of difference be investigated under the existing treaty by reference to this commission?

Mr. KING. I think it extremely likely that it should come into this court. May I be allowed to refer to one or two things that have occurred? In 1903 a deputation of the Marine Association went to Buffalo to meet the Lake Carriers' Association in order to secure some uniformity in the rules of the road. We found that there would have to be an act of Congress on that side of the line to amend them. It was easier for us on our side to make an amendment. It was on my brief that certain amendments were made, and I fought hard to have absolute uniformity. I did not get it, because at Ottawa, in some way or another, there was a sort of feeling toward the old rules that we had always had, and the result was a hermaphrodite affair. It was neither flesh, fowl, nor good red herring. Two years ago I went to Ottawa again on behalf of the vessel owners and urged the adoption of what is called the "American White Law." It was agreed to to this extent, that we actually had put into print an amended list of rules of the road in Canada, incorporating every one of the rules from the American side which differed materially from the Canadian, but it left the framework of a different character. It left the general sense the same, in a great many cases, but it left wording and general arrangement substantially different, and you are up against the same difficulty. It was decided that it was better to defer the adoption of that until both parties could accept the same set of rules.

The CHAIRMAN. The procedure would be very simple if the matter were referred, under the treaty, to this commission.

Mr. KING. That is what I was going to say, that it could be easily settled if both parties could come before the same commission and set forth what they believe to be good on each side. As a result of the evidence then given the commission could adopt one set of rules and the action taken would be a matter of great satisfaction to both sides.

The CHAIRMAN. My thought was this: That under the treaty the initiative would have to be taken by one or the other of the Governments in order to bring the matter before the commission. If the Canadian Government, desiring to have uniform regulation, should formulate propositions to submit to the Government of the United States and ask that they consent to a reference to the commission, and then both sides should come before the commission and submit such regulations as they might agree on, the commission could report its conclusions and recommend to the two Governments what they may think is necessary.

Mr. KING. I should be very glad to lay before the Dominion Marine Association at home the suggestion that it should present the matter to the Government at Ottawa for the consideration of a common tribunal of this kind. I think that would be welcomed.

Mr. POWELL. That would be the first step in the way of a solution.

Mr. KING. Yes, sir. That would, however, apply to another very serious question. The Maritime Conventions Act of Great Britain divides the damage in a collision case in proportion to the degree of fault between the two vessels. In the United States, and in Canada, up to the last session of Parliament, they divided half-and-half, 50 and 50.

Mr. POWELL. That is where they are both to blame.

Mr. KING. At the last session of Parliament an amendment was brought in, in pursuance, by the way, of some treaty, I understand, to bring the Canadian law in absolute conformity with the Maritime

Convention Acts. I, myself, with others, pointed out certain difficulties that would arise, but the amendment was adopted, excluding the Great Lakes and that part of the St. Lawrence River above Montreal, and also connecting and tributary waters. This is the Maritime Conventions Act, 1914. It is true that it preserves uniformity on the lakes, but this is attained by creating a lack of uniformity in our own country. This question might well come before the commission with the others raised.

The CHAIRMAN. Is there anything further, Mr. King?

Mr. KING. I have nothing further to add myself.

Mr. POWELL. I might say, for the benefit of your marine association, that Mr. Phelps's scheme is a very simple and very effective one. It was simply to have a jet of steam pass into some reservoir or tank in which the excreta from the water-closets on board was collected, and by raising that to a certain temperature sterilize it and then pass it out. It might be unnecessary even to have a tank. It might be allowed to accumulate in the sewer.

Mr. KING. I did not propose to press the point at the present time, but as you have raised the question, may I ask whether this has been applied in practical experiment to any vessel under actual conditions of navigation?

The CHAIRMAN. He stated at New York last May that it was the intention to install a plant of this kind on board vessels during the summer for experimental purposes. Whether that has been done or not we do not know.

Mr. KING. I have the advantage of having seen the discussion which took place at Ottawa in October last, a copy of which was furnished me upon my application for information as to what had been done, and I saw that inquiries made by Dr. McLaughlin there led to a quotation of Mr. Phelps's scheme. That is all the information we had, outside of a document that the chairman has in his hand, and we could not gather that it had been applied to any vessel, and we were anxious that there should be some experiment.

The CHAIRMAN. I do not know whether you have the testimony taken before the commission of the six sanitary experts in New York?

Mr. KING. Yes; I have.

The CHAIRMAN. You will find that each one of the sanitary engineers expressed his opinion in regard to this proposition of Mr. Phelps, and the summary of the testimony of the six experts, I think, calls attention to what I read this morning.

Mr. KING. I do not like to pursue the point indefinitely, but may I call attention to the fact that time and again it has been proved that the theory will not work out in practice, and it would have to be a matter of experimentation on a vessel under sailing and weather conditions which we can not deal with here.

STATEMENT OF MR. J. W. NORCROSS, OF TORONTO.

The CHAIRMAN. Are you a vessel owner, Mr. Norcross?

Mr. NORCROSS. I am a vessel manager.

The CHAIRMAN. How long have you been a vessel manager?

Mr. NORCROSS. For 10 years.

The CHAIRMAN. What information can you give the commission with respect to the practice of vessels in the matter of taking on polluted water for ballast or for drinking purposes, and the matter

of the disposal of their sewage indiscriminately along the path of their travel?

Mr. NORCROSS. In reference to the disposal of sewage over certain lanes, I am afraid you have got the impression that these vessels follow one another immediately astern. They do not. Sometimes they are 5 miles apart. The lane may extend 10 miles in width. They are not following one another and depositing sewage in the same place.

The CHAIRMAN. But in passing through the Detroit River they would have to pass directly in the same track?

Mr. NORCROSS. Yes.

The CHAIRMAN. The same is true with respect to the St. Clair River and the St. Marys River.

Mr. NORCROSS. I am under the impression that a good deal of the pollution that is found in the river is caused by the disturbance of the screw of the vessel in tearing up the bottom and that sort of thing.

The CHAIRMAN. The vessel also helps toward the extension of the sewage from one side to the other.

Mr. NORCROSS. You mean with reference to the screw of the vessel?

The CHAIRMAN. Yes.

Mr. NORCROSS. I would hardly say that. It is probably twice the width of the ship.

The CHAIRMAN. What is the practice with respect to taking on ballast in heavily polluted areas and discharging that ballast in less polluted areas near the water intakes?

Mr. NORCROSS. If you have to stop the vessels from taking polluted water in the harbors you would have to change your system of loading and unloading in the harbors. You would have to get them low enough down to get the loads out. The same thing occurs at the head of the Lakes. There are certain docks that the vessels go to to load where the vessels have to have four or five thousand tons of water ballast in order to get their spouts in.

The CHAIRMAN. Would it not be practicable for the vessels to obtain their ballast outside of the harbor limits or away from the intake and discharge at some two or three miles before reaching their destination?

Mr. NORCROSS. A certain number of ships can do that. In the case of a marine vessel of 12,000 tons, of course, it depends entirely on what dock she unloads at. She has to have water ballast. Without any water ballast in those vessels they draw 10 or 12 feet aft and nothing forward, and those vessels have to turn around in port. The tugs have not power enough. The vessel would carry away the tugs and everything else and go up on the beach.

The CHAIRMAN. Is it not true that the vessels carrying water ballast discharge that ballast before coming into the harbors?

Mr. NORCROSS. In a good many cases they do. If the wind is blowing hard she has to have water ballast in when going in port just the same as she does in going out into the lake.

Mr. GLENN. There is no general rule with regard to that, is there?

Mr. NORCROSS. I do not think there can be any rule applied to it.

The CHAIRMAN. Is that water, when it is discharged outside of the harbor, discharged with reference to the location of the intakes of the waterworks?

Mr. NORCROSS. I do not believe there is any rule regulating that at all. It is not every vessel that carries water ballast. There are a number of them that go up loaded with coal. Probably a third of the vessels go up light. Those are the only ones that carry water ballast.

Mr. GLENN. Could there be a general rule with the weather conditions as they are?

Mr. NORCROSS. I do not see how you could make any hard and fast rule. I believe it could be regulated to this extent—that a vessel could be so restricted that she could not pollute the water at the waterworks intake. That could be done. For instance, take the vessel that takes water at Cleveland. She takes it out of the river which goes out into Lake Erie. She discharges it at Duluth, and the intake pipe at Duluth is probably 10 miles or more outside of the harbor. She is not polluting the water at Duluth, because the water is already polluted.

The CHAIRMAN. But that vessel could be by regulation prevented from discharging that polluted water within a certain distance from any waterworks intake?

Mr. NORCROSS. Absolutely so. There is no reason why that should not be done.

The CHAIRMAN. There is no particular attention paid by vessel masters or captains of vessels in the matter of discharging pollution with reference to intakes, as I understand it?

Mr. NORCROSS. No, sir. A vessel that leaves port with water ballast does not always arrive at the head of the lake with water ballast. If the weather is calm the vessel will make better travel with the water ballast pumped out.

The CHAIRMAN. These vessels have considerable drag when they are light, have they not—that is, they draw a good deal more water aft than forward?

Mr. NORCROSS. Yes.

The CHAIRMAN. They are practically on the top of the water when they are absolutely light?

Mr. NORCROSS. Yes, sir.

Mr. POWELL. Take a vessel steaming with a strong wind abeam; do you imagine that she would go very far on her course in that condition?

Mr. NORCROSS. No, sir; she would not.

Mr. POWELL. You could not prevent her bow from swinging around?

Mr. NORCROSS. No; she would not swing around, but she would make so much leeway that you could not handle her.

Mr. POWELL. Do you think you could keep her bow to the wind?

Mr. NORCROSS. No. It would be absolutely necessary to have water ballast—as much as you could get.

Mr. POWELL. I have had some experience along that line. I would not like to go to sea in a ship under those conditions.

Mr. NORCROSS. The reason the ballast is put in is primarily for safety purposes.

The CHAIRMAN. What is the practice with respect to taking on water for drinking purposes, as to the place from which the water is taken?

Mr. NORCROSS. I can only speak for our own company in that respect. At the meetings that we have in the spring those things

are taken up and discussed with the captains, but as far as our passenger boats are concerned we take the water from the areas that are designated by the provincial board of health. The water is pumped into the tanks and the tanks are locked, and the chief engineer carries the keys. We have no regulations for the freight vessels other than the general talk at the annual meetings that we have with the captains.

Mr. MAGRATH. Passenger vessels take more precautions now than they did in years gone by, do they not?

Mr. NORCROSS. Yes, sir.

The CHAIRMAN. How long has this regulation in respect to passenger vessels been enforced?

Mr. NORCROSS. During the last three or four years; I could not say exactly how long.

Mr. POWELL. That is under a provincial act?

Mr. NORCROSS. Yes, sir.

The CHAIRMAN. How many men are there in a crew on your freight vessels?

Mr. NORCROSS. From 16 to 22.

The CHAIRMAN. Have you had any cases of typhoid fever on your freight or passenger vessels in the last two years?

Mr. NORCROSS. We had two reported this year from the passenger vessels, none from the freight ships. The two cases that were reported were on excursion vessels that were only operated during the daytime. The members of the crew may have been ashore and gotten the infection there. We run between Sarnia and the head of the Lake; between Sarnia and the Soo, from Toronto to Lewiston; from Toronto to Hamilton, and from Toronto to Rochester, Montreal and Pictau.

Mr. POWELL. In the two cases mentioned the typhoid fever was among the passengers?

Mr. NORCROSS. No, sir; those cases were among the crew.

Mr. GLENN. You say there is no regulation in regard to freight boats as to where they get the water. For their own protection they usually try to get water from a pure source, do they not?

Mr. NORCROSS. Oh, yes. The general impression with all the captains is that if they get water in the middle of Lake Ontario or Lake Huron or Lake Erie it is pure. I have known instances of where they pump water out of the Detroit River for their tanks, but that was some years ago and they probably know more about it now.

Mr. GARDNER. How large a fleet does your association control?

Mr. NORCROSS. I do not know.

The CHAIRMAN. How many have you in your company?

Mr. NORCROSS. We have only 100; that is, different classes of vessels.

The CHAIRMAN. All plying on the Lakes and their connecting waters?

Mr. NORCROSS. No; we have six plying on the ocean.

The CHAIRMAN. And the rest are on the Lakes and rivers?

Mr. NORCROSS. Yes, sir; on the Lakes and rivers.

Mr. POWELL. Have you given any study to the subject of sterilization of water on your vessels?

Mr. NORCROSS. No. We are trying to get help from the health department. We put in an apparatus last year. It was a chlorinating apparatus. We tried it last year, but it did not satisfy the

health authorities. They have informed us this year that we should put on extra tanks and take the water from the areas that they designated instead of trying to chlorinate it.

(The commission thereupon took a recess until 2 o'clock p. m.)

AFTER RECESS.

The commission reassembled at the expiration of the recess.

Mr. A. A. Wright, of the St. Lawrence & Chicago Steam Navigation Co., was called:

Mr. TAWNEY. Before Mr. Wright proceeds I want to call the attention of Mr. King and Mr. Livingstone to a report of the Federal Health Service of the United States on the water supply of ships. In view of the statements that were made this morning that there were few cases of fever on ships, I think part of this report should go into the record. This report says:

The fact that drinking water aboard vessels operating on the lakes and rivers of this country is frequently responsible for serious outbreaks of typhoid fever and diarrheal affections, and the generally high incidence of these diseases among crews and passengers clearly demonstrate the immediate necessity for the promulgation of regulations and the adoption of efficient measures to control a situation which is of paramount importance, both to the health of the traveling public and the commercial welfare of inland waterway transportation.

Of the outbreaks during recent years, probably the best known and most widely reported in journals and newspapers throughout the country was the one which occurred in the summer of 1907 on a big steamer of the Great Lakes. It is stated that during one short period of the summer's cruise 77 cases of typhoid fever developed as the result of the use of impure drinking water taken from the Detroit River. Surg. L. L. Lumsden, of the United States Public Health Service, states, in his report of an outbreak among 1,200 passengers on a Mississippi River excursion steamer in 1912, that there occurred over 600 cases of diarrhea and 13 cases of typhoid fever, with 5 deaths. Investigations by this service of similar outbreaks on three Great Lakes vessels during the summer of 1913 showed that out of a total of 750 people there were over 300 cases of diarrhea and 52 cases of typhoid, with 7 deaths.

The foregoing instances do not by any means give a proper idea of the annual number of cases of typhoid fever and intestinal diseases in which the infection is undoubtedly contracted aboard vessels, but are merely cited as being illustrative of the intensity of distinct outbreaks which may occur at any time as a result of the entirely too prevalent use of polluted drinking water on ships. When we consider that the records for the fiscal year ending June 30, 1913, show over 1,600 steam vessels operating on the Great Lakes alone, and that during this same period there were carried on these Lakes over 16,000,000 passengers, it is easy to realize that our inland vessels may play more than a minor rôle in the maintenance of the country's high typhoid fever rate.

In reference to the incidence of typhoid among crews only, it may be stated that during the calendar year 1913 there were treated at the stations of the United States Public Health Service in the Great Lakes region 144 cases of typhoid fever among seamen of lake vessels. The seasonal prevalence of diarrhea along lake crews is so common as to be looked upon by them as normally incidental to the summer's sailing. Though of course the roving life of a sailor exposes him to many sources of infection on shore, from such evidence as is available it may be concluded that a large proportion of the typhoid cases and by far the majority of diarrheal cases among them may be properly attributed to the use of sewage-polluted drinking water on board, the facts developed in the investigations of distinct outbreaks clearly bearing out this deduction.

I want to call your attention to that official report, and to have it recorded with the hearing.

Mr. WRIGHT. I heard that report read, and it certainly is a surprise to me, because our company has been operating about 24 years,

and as far as I can learn we have had only one case of typhoid fever on our boats in all that time, and that was the captain of one of them, in 1913, last year, when he was trading to Montreal. They had been taking some of their water supply from the St. Lawrence, between Kingston and Montreal, until the captain was taken sick, and then they stopped it. I can not speak for the other companies. The Government has not issued any chart showing polluted areas of water, and we have nothing to go on, and the only general information our men have is if they can take their water supply from somewhere in the middle of Lake Ontario, the middle of Lake Erie, or the middle of Lake Huron, or the middle of the Georgian Bay, or the middle of Lake Superior they are getting good water. That is all we know. Our instructions to our men are to that effect, and of course we do not know whether they are carried out, but we naturally expect that they are, as they have to drink the water themselves. Our instructions are that they are to take their drinking water from these areas, as near as they can get it, to the middle of the Lakes, on their tracks and to take as little water as possible in Lake Erie, on account of the contamination, which must necessarily come to Lake Erie through the St. Clair and Detroit Rivers. Another thing is, that on our boats we have no fixed water pipes through which a supply can be pumped from the Lakes into the water tanks; we have always insisted that our water tanks shall be filled by hose, when they are in what are considered safe areas to take their water. The actual method I have seen followed is that they will start the pump, which they use for their water supply, with the hose connected, and turn the hose overboard, and they will pump the water through that hose for at least 15 minutes, and then they fill their tanks. We also instruct them to wash out their tanks with chloride of lime at least once a month, and oftener in the summer time. Of course, I do not know whether they do that or not. We have also instructed them that if they have any doubt about their water supply they should chlorinate their water by using a weak solution of chloride of lime.

Mr. TAWNEY. Is it the duty of anyone on board to see that your regulations are carried out?

Mr. WRIGHT. The first officer does that. It is the duty of the first officer to attend to the water supply, and I believe that is usually the practice, although we know that on boats men get indifferent to a great many of these things. Our experience is that in 24 years we have only had one case, and the captain does not know whether he got the infection on board the boat or got it ashore, because no other member of the crew was affected in any way.

Mr. TAWNEY. Have you passenger boats?

Mr. WRIGHT. No; all freight boats. We operate only five freight boats.

Mr. MAGRATH. Have you any provision in the form that you use which calls upon the officers to give you a brief history of what has occurred on the voyage. For instance, do they let you know whether men have been ill on the trips?

Mr. WRIGHT. In case of sickness on board the boats the captain usually reports that. There might be a case where a man would become sick and go ashore, and they would hire another man in his place. There is no regular rule governing that.

Mr. POWELL. Do they keep a log?

Mr. WRIGHT. Oh, yes; and any serious case is reported. But a man might quit the ship because he did not feel well and we would not know anything more about him.

Mr. GLENN. And you say in your experience there has been only one case of typhoid?

Mr. WRIGHT. That is all that has been called to our attention.

Mr. GLENN. How about cases of diarrhea or summer trouble?

Mr. WRIGHT. We do not know anything about that. You can not tell what might produce that, for it might be the food as well as the water. The men might overfeed in hot weather, and, judging by what it costs us to feed the crews, I would not be surprised if they were often troubled that way.

Mr. TAWNEY. The report I have read states the number of cases treated at Federal hospitals along the Lakes last year, and I think they amounted to 77.

Mr. WRIGHT. Another thing you must take into consideration is that some of these men are only on the boat for the trip and they are on shore for a week or more. They keep drifting back and forward; that is, the grade who are called seamen. The only men who live on the boats the season through are the officers, and the only fair test as to what the drinking water on the boat would be is to take the percentage of officers who have lived on the boats for the season from spring to fall. It would be unfair to charge the boats with cases of typhoid among the drifting members of the crew. If the drinking water was bad the officers who live on the boats would be affected as well as the crew.

Mr. TAWNEY. In so far as your vessels contribute to the pollution of these waters, which are used by the municipalities as well as by the vessels for domestic purposes, do you or do you not think that steps ought to be taken by shipowners to treat their sewage on board the vessels before discharging it into these waters?

Mr. WRIGHT. I think there can be only one answer to that, and that is that it would be desirable, but I think on a fair basis of comparison you would find the amount of contamination from the boats on the Lakes would not exceed 1 per cent of that produced by the towns. Therefore, if you eliminate that 1 per cent entirely, you have not yet got anywhere.

Mr. TAWNEY. Pardon me right there for interrupting you, but supposing your vessels should discharge their sewage in the vicinity of intakes of waterworks of municipalities thus creating an overload on the purification plants of the intakes, don't you think that ought to be stopped?

Mr. WRIGHT. Unquestionably, but if the Government would issue a chart, showing areas where they were not to discharge any sewage, they could easily live up to that; there is no trouble about that. You must also take into consideration the fact that on any average freight boat there is only an average crew of 20 or 21 men. The percentage of these men who would be using closets passing intakes would be infinitesimal, the boats are not discharging sewage the whole 24 hours; as a rule it is about once a day. The boat is usually traveling about 10 or 12 miles in the hour. The amount that could be discharged from any one boat alongside of any intake pipe would have no appreciable effect on that intake. I think that idea is exaggerated. I am free to admit that there may be some pollution, but if you take the history of the Lakes and the trade on the Lakes, and look at our

modern ships to-day as against the ships of even 10 years ago, you will find that vessel owners have never hesitated to spend money wherever they could accomplish something for the public good. If the time ever comes, or if you can bring it about that municipalities stop polluting the water, you certainly would have the right, regardless of what it cost to the vessel owners, to stop any pollution that may be caused by their ships also. But I feel, while I am quite in sympathy with you in this matter, that vessel owners should have two things done before they are asked to go to any expense. That is, that the municipalities should stop pollution, and I claim it is cheaper for the municipalities to stop it in proportion to the number of population than it is for the boats. It will cost the boats more per capita to equip them to treat their sewage than it will to equip the municipalities. I think I am safe in saying there is not a vessel owner on the Lakes who would not put one of his boats at your disposal to experiment with as to what would be the most efficient and economical method of treating sewage. We are not sanitary experts, but we know there are a lot of problems to deal with in this matter.

For instance, boats trading on Lake Superior any time between now and the closing of navigation on the 15th of December have to meet temperatures of anywhere from zero to 25 below. Where these closets are now fixed on some of these boats there is no room to put in any kind of a tank, and so that would mean doing away with a lot of the present closet accommodations. We also know that we have to have closet accommodation at both ends of our lake freighters, because I have been on board myself when it was more than a man's life was worth to go from one end of the ship to the other when the seas were breaking over. In any experiment you would conduct you would have to have one tank forward and one aft, and you may have more. But I think in any new ship that was constructed in the shape of a freighter you could get along with one forward and one aft. You would have to provide in some way so that frost would not interfere in the intense cold weather, because in the forward end this discharge goes through the forepeak of the vessel, and the pipes would freeze and burst and your appliances would be out of order, and the sewage would be dumped into the forepeak of the vessel. There would not be the same danger from freezing aft, but you would have to have it arranged in some way so that the tank would not cause any inconvenience in the operation of the ship; and you would have to see that there would be some way so that it could be cleaned out, and also that in the tumbling of the sea, or if you were using disinfectants, it would not create odors that would make the ship uninhabitable, so that you could not get a crew to stay on her. The moment you destroy a ship as a commercial proposition you put her out of business.

Mr. TAWNEY. How are these ships heated?

Mr. WRIGHT. By steam from the boilers aft, which is carried forward through the cargo holds. They have steam forward, but the only method I see mentioned in your report is treating this crude sewage with live steam. That might create odors; or, if you turned that steam in there, how are you to prevent that steam from coming up into the lavatories and poisoning the whole place with the smell from it? That is why I think this commission should get their sanitary experts at work to devise the best and simplest scheme that can

be found, and to make their experiments by putting a plant in two or three boats and let it be tried out. If you get something that is practicable, I do not think you will find any vessel owner objecting to use it. But we can not afford to do the experimenting, because there are none of us sanitary experts, and we would be going it blind without knowing anything about what we are doing. It may be found that chloride-of-lime treatment would be simpler than treating it with steam, but that is something these experts can figure out.

Mr. MAGRATH. Do you think there should be plans provided for the steamship people?

Mr. WRIGHT. We will put a boat at your disposal, and you can put your plant in the boat and experiment with it.

Mr. MAGRATH. Do you think there should be plans of the Lakes, showing the polluted areas, furnished to you?

Mr. WRIGHT. Yes; I think that information should be given on our charts. If there is an intake pipe somewhere, I think there should be a circle placed around that area on the chart, and stating that the ships should not pump out any ballast or discharge any sewage in its neighborhood. There are signs on the shore, saying "Submarine cable; don't anchor here," or "Water supply pipes; don't anchor here," and you could put a notice saying that the intake pipe was near and they should not discharge sewage, and the boats would have no object in disobeying any rule of that kind. All they want to know is what they are supposed to do, and if we find any captain transgressing, he could be punished.

Mr. TAWNEY. Do you know that in an order of the provincial government certain areas are indicated from which you should take your drinking water?

Mr. WRIGHT. Officially I know nothing about it. No provincial official has ever sent to our office the instructions of any kind regarding our water supply or discharge of sewage, or anything of that kind.

Mr. TAWNEY. I understood some gentleman this morning to refer to that.

Mr. WRIGHT. In connection with the passenger steamers out of Toronto, the medical health officer in Toronto has been very active, and he has taken that question up; but I am talking about freight boats, which I know something about. On our charts we have nothing to indicate where the vessels have any information as to where they should take their drinking water. What we have been doing is that the Lake Carriers' Association have issued a bulletin to our men, and we endeavor to insist that the captain of the boat shall live up to that.

Mr. MAGRATH. When you started out, you were strong in your statement that while you gave instructions that water should be taken at certain points, you appeared to lay stress on the fact that you did not know whether the instructions were carried out or not.

Mr. WRIGHT. I could not know.

Mr. MAGRATH. Did I misunderstand you in that?

Mr. WRIGHT. You did not misunderstand me; I am quite frank about it. I do not know and I can not know whether they do it or not. How could I know unless I were on board to find out whether they were doing it or not?

Mr. MAGRATH. It appears to be rather peculiar that you would not have sufficient control to see that your orders are carried out. I sup-

pose you could say that certain things should be done on your boats and that there would be trouble if they were not done.

Mr. WRIGHT. That is the position I take, but how am I to know whether it is done or not?

Mr. MAGRATH. What use would there be in the Government giving you plans showing where the water should be taken, if there is going to be any question in your mind that the water would not be taken there?

Mr. WRIGHT. I have no really serious question in my mind but that at least 90 per cent of the men would live up to their orders; but what I meant you to understand is that we have no knowledge as to how far the orders of this kind would be carried out. I can give you an illustration. Between now and the close of navigation we may order our men that we want them to take all their water supply in the middle of Lake Huron. There may be a snowstorm and such a gale that the men can not take their water supply there, and they would have to take it at the next best place they could. You can not lay down any hard and fast rules that men have to do certain things on the Lakes at certain times, because sometimes conditions are entirely against them. What I think should be done, is that the Lake Carriers' Association and the Dominion Marine Association should get information from the health department whereby they would know how much chlorine to put in the water, if at any time they were compelled to take water in certain areas that would make their water supply unsafe. You may make a rule as to where you should take your water in or pump your water ballast out, but the weather will fix that, unless you say the boat must stay in port until weather conditions allow her to leave that place without ballast.

Mr. POWELL. How do you take the water ballast into the ships?

Mr. WRIGHT. It is allowed to run in through the sea cocks. If you are running in the Lakes you have to pump it in, because it will not come in fast enough through the sea cocks on account of the momentum of the vessel. There are pumps on board ship that are for no other purpose than to handle the ballast water.

Mr. GLENN. Your idea is that the Government should take some of these vessels on which to make a test of some scheme and to put experts on board to see whether it works out or not?

Mr. WRIGHT. Yes; that we should not be asked to experiment blindly.

Mr. GLENN. Why not? You are the offending party and the cause of the trouble, and why should the Government have to bear the expense?

Mr. WRIGHT. We are the offending party, I grant you, but we have always pursued the present system.

Mr. GLENN. That is no reason why you should continue.

Mr. WRIGHT. A ship is a commercial proposition, and the minute you destroy her as a commercial proposition you put her out of business. The country requires the ship, and there is no place in the world where freight is carried as cheaply as on the Great Lakes. We have not the means of experimenting in this matter, but the Government has, and they can experiment cheaply, and when they have been satisfied with their experiment they can make an order that the necessary plant shall be established on the ships. I might experiment and try one scheme, and another fellow might try an-

other scheme, and when we got through you would say that the thing was no good and that we would have to use some device provided by the Government.

Mr. GLENN. It seems to me that while you are benefiting the country you should also protect as far as you can the health of the people. As you are the offending party it would seem to me that you should get the best scheme. If necessary the Government might supply sanitary experts, but it seems to me that the remedy should be supplied by the offending party.

Mr. WRIGHT. You are doing this for the good of the public which will benefit by it, and it seems to me that the Government should do the experimenting.

Mr. TAWNEY. Your theory is, Mr. Wright, as I understand it, that whatever experiments are made should be made by authority of the two Governments, with a view of securing a uniform appliance that would suit all the vessels in the lake service?

Mr. WRIGHT. Yes; and that would be suitable for the purpose for which it is intended.

Mr. TAWNEY. Suitable and practicable for that purpose.

Mr. WRIGHT. We would simply be wasting our time in any experiment we would conduct. You have to have trained men for that.

Mr. GLENN. The Government would not go to work to experiment on the treatment of raw sewage for Detroit, and why should we require the municipalities to treat their sewage and not the boats?

Mr. WRIGHT. Yes; but as I understand it the treatment of sewage from cities has been proved already, and is in actual use in Europe, by means of septic tanks. There has been no scheme inaugurated yet for the treatment of sewage on the boats.

Mr. GLENN. This commission has not devised any system for the treatment of sewage by municipalities.

Mr. WRIGHT. I understand that Toronto has a trunk sewer and septic tank in use, and several other cities in the United States are treating their sewage in the same way. In Europe it is a very common practice and they have solved the problem there, as far as cities are concerned, but so far as I can learn the question has never yet been taken up with regard to vessels on the lakes or anywhere else. Of course, the bulk of the world's commerce is on the ocean, where it makes no difference.

Mr. POWELL. I would imagine that the problem had presented itself to be dealt with before this.

Mr. WRIGHT. I have never heard of it.

Mr. POWELL. Your position is that you are willing to do what is necessary, if what is necessary is pointed out to you?

Mr. WRIGHT. Yes; so far as I am concerned.

Mr. POWELL. And we, as a commission, are appointed for the express purpose of finding out what is necessary. I really think it rests with us, if you do not know and have no scheme to offer. I think the commission will have to take the onus of recommending to the two Governments what is necessary in the premises.

Mr. WRIGHT. Speaking for myself, I have not brains enough along these lines to know what is wanted.

Mr. POWELL. You have brains enough.

Mr. WRIGHT. I have not the knowledge, or education, or experience in these expert matters, but I know it is a question that will require

a great deal of study, and there will have to be experiments made. You have frost to contend with, and the plunging of the vessel in the seaway, and whatever is applied will have to meet the conditions. Another thing is, how are you going to do away with the sewage from tugs and smaller boats, sailboats, and yachts, on which you can not possibly install a plant that you would install on larger vessels? These small boats sail over intakes and everything else, and you have to take the whole question into consideration.

Mr. POWELL. That pollution may be so small that it would not be worth considering.

Mr. WRIGHT. It is all relative. I claim that the pollution from navigation is only 1 per cent and the small boats are a portion of that.

Mr. GLENN. Your judgment is that the danger by pollution from the boats is sufficient to demand that the Government should take some steps for the purpose of protecting the water against your pollution?

Mr. WRIGHT. I would not like to say that, because I do not know. I can only give my opinion, and it is that until the pollution from municipalities is stopped our share of the pollution is so small that nothing can be accomplished by preventing it. You can eliminate the boats' share of the pollution completely and still the public would be just as much in danger as they are now. That is the way it strikes me.

Mr. GLENN. Our duty is to say what the cities and towns ought to be required to do, as well as what the shipping interests ought to be required to do, and to deal with them both together.

Mr. WRIGHT. If the cities, towns, and villages are made to stop pollution, then the ships should be made to stop it also.

Mr. POWELL. You will not be made to stop it before the cities are made to stop it; you need have no fear as to that.

Mr. WRIGHT. I think this commission is the proper commission to have the experiment conducted and that we would be doing our share if we put boats at your disposal and assure you that we will give any suggestion an honest trial.

Mr. GLENN. You are distinguishing between the expense of investigation and the expense of installation.

Mr. WRIGHT. We are not asking the Government to install the plant; we will install them if they accomplish anything.

Mr. MAGRATH. You say that the pollution caused by vessels amounts to only 1 per cent; can you say how you reach that conclusion?

Mr. WRIGHT. Well, that is roughly speaking. It is said that there are fifteen or sixteen million passengers carried on these boats, and they would not average more than one day on board a ship. I should say that there would easily be five millions or six millions of people living around international waters, and multiply that by the 365 days in the year and you will see the percentage. That is the only fair basis you can get it on.

Mr. MAGRATH. That is the way you reached that conclusion?

Mr. WRIGHT. Yes, I would say that 1 per cent would be the maximum attributable to the boats.

Mr. TAWNEY. If there is any gentleman present who wishes to put questions to these gentlemen, he now has an opportunity of doing so.

Mr. LIVINGSTONE. It would seem that I labored under a misapprehension as to one question that was asked, and that is as to whether there was any area where drinking water should be taken. I misunderstood the question. I thought I had explained that so far as the Lake Carriers' Association is concerned, we have a rule about that which, of course, only extends to our own association, as we have no power outside of that. I want to make it clear, and I would like to have it go into the record, as demonstrating this fact, that in every reasonable way, so far as lies within our power, we have tried to obtain sanitary conditions and are willing to cooperate with this commission in that respect. I have two circulars here which I want to go into the record, as they bear on sanitary matters and the taking of water for ships, and these circulars will explain themselves.

Mr. POWELL. On what data do you base the information contained in circular No. 68?

Mr. LIVINGSTONE. We issued this order on May 14, 1914.

Mr. POWELL. On what data did you base the regulation about the taking of water?

Mr. LIVINGSTONE. We state in the circular that the information is taken from the report issued by the United States Government as to the areas where water should not be taken.

Mr. POWELL. Do you remember what official document you got that information from?

Mr. LIVINGSTONE. I can not remember just now, but I will file it with the commission.

Mr. TAWNEY. It is a report of the Public Health Service at Washington.

Mr. GLENN. The circulars contain your recommendations, but what plan have you adopted to see that your recommendations are carried out? Do you require the officers of the boats to make a report?

Mr. LIVINGSTONE. Yes, sir; on every boat that belongs to the Lake Carriers' Association. Of course, we can only issue orders so far as our own association is concerned.

Mr. GLENN. Is that an order or a recommendation?

Mr. LIVINGSTONE. We insist on them carrying it out and we put it under one man's control, whose duty it shall be to see it is carried out.

Mr. POWELL. Is it like any other rule or regulation of a company whose order is to be observed.

Mr. LIVINGSTONE. Yes; but I have to qualify it to this extent. It is said that one can call spirits from the vasty deep, but if we call them will they come? We can make all the rules we can possibly conceive, but the question is whether they will be carried out.

Mr. TAWNEY. Your organization is a voluntary organization?

Mr. LIVINGSTONE. No, sir; we are incorporated and are subject to certain rules under the Constitution.

Mr. TAWNEY. You have your by-laws?

Mr. LIVINGSTONE. Yes; and I want to say very frankly that in my long experience in the business I know of no set of men who are more prompt to do the best they can in the public interest—I am speaking of the managing owners and those who have absolute control of the boats. They are not only prompt to respond to all just demands made on them, but they do it willingly and gladly. I call

your attention to the fact that you may issue the most peremptory rules you can think of, and you can punish a man who breaks these rules, but you can not put him in gaol although you can discharge him. Of course, if a man violates these rules you do not always know it.

Mr. GLENN. Do you ever have an inspection made to see whether they carry out your rules?

Mr. LIVINGSTONE. We do; but in the end you have to depend on the man, and all our men are not saints, and neither are you and I when we get down to that. I put it to the commission whether it is possible, among 17,000 or 18,000 men, to have all your rules strictly obeyed. I do not care what the penalty may be, I doubt if every rule will be obeyed among any class of men numbering so many. A man knows that if he commits murder he will be hanged, but still some people will commit murder.

Mr. GLENN. The idea I had in mind was that on the railroads they have men, unknown to the officers, who go around to see that these officers do their duty; they are called "spotters." Do you have any inspectors who go on to the boats and see that the men who are ordered to do certain things do them?

Mr. LIVINGSTONE. We have no spotters. You can see that where there are 18 or 21 or 22 men on a boat we could not have spotters even if we would. You take a railroad that traverses thousands of miles, and I can name on the fingers of my hand, adding one finger to it, the men who control all the railroads in the United States. I make that assertion without fear of contradiction, and I can prove it. Now, Gov. Glenn, with a railroad covering thousands and thousands of miles, they can shift these spotters or inspectors around so that the men will not know them, but it would be pretty difficult for us to do the same thing. So far as human precaution can be taken we take it, and we do not hesitate to discharge a man if it is necessary. Of course we do not discharge a man without good reason, but a man knows that he places his position at risk if he does not carry out the rules. We have to deal with a class of men—I almost hesitate to say it—who have not had the advantages of education and surroundings and environment that you and I have had, and you can not expect these men to look upon these questions as you and I do, and so you have to do the best you can. But you put laws on the statute books and you attach a penalty to their infringement, but still these laws are not lived up to. I believe we get just as near to carrying out our rules in the Lake Carriers' Association as the average of human nature will allow.

Mr. TAWNEY. These circulars which you have handed in, Col. Livingstone, will be placed upon the record:

LAKE CARRIERS' ASSOCIATION.

Secretary's Office, Cleveland, Ohio, May 14, 1914.

CIRCULAR No. 68.

To the Members of our Association:

The welfare committee in its effort to fulfill its duties with respect to those matters which have been delegated to it by your body for consideration respectfully submit the conclusions and recommendations as outlined below.

These recommendations have been reached after numerous conferences and much thought, and are the things which in its judgment should be actively

260 REMEDIES FOR THE POLLUTION OF BOUNDARY WATERS.

adopted by all lake carriers' boats at this time. While there are other subjects which merit attention, the idea of your committee has been to bring before you at this time only the more important, and trusts to the future to develop the scope. The present recommendations are along the line of sanitation. The committee does not wish to burden you with a dissertation on the benefits and necessity of this action. The benefits are sufficiently obvious as to need no argument; the necessity will be recognized by the careful student of the trend of economic thought.

The outline of the campaign for sanitation is as follows:

1. That dealers in food supplies be asked to cooperate.

2. That individual boats be asked to cooperate.

For the purpose of reaching the dealers a circular has been prepared, of which the attached is a copy and which is self-explanatory.

It was decided to ask the cooperation of the boats on the following subjects:

Pure drinking water.

Sanitary water tanks.

Clean refrigerators.

Food free from contact with impure ice.

Sanitary handling of meats.

Dry bedding.

A few remarks are submitted as to the importance of each one of these subjects.

WATER.

The prevalence of dysentery attributed to the taking of drinking water from those areas which are subject to the influence of shore sewage. An exhaustive report as to the areas where water should not be taken has been issued by the United States Government. These places are as follows:

LAKE SUPERIOR.

Duluth to abreast Two Harbors, and with or after S. W. to N. W. winds Duluth to abreast Sand Island.

SOO RIVER AND APPROACHES.

Whitefish Point, Lake Superior, to abreast Spectacle Reef, Lake Huron.

LAKE HURON.

Fifteen miles outside Ft. Gratiot Light. With or after strong W. to N. W. winds, Pt. Aux Barques to St. Clair River, unless at least 10 miles offshore.

LAKE MICHIGAN AND STRAITS.

West or south of a point at least 12 miles off Milwaukee on Pt. Betsy course. With S. to N. W. winds, 25 miles off Milwaukee. Beaver Island to Spectacle Reef. If following west shore, at least 10 miles offshore. With fresh S. E. to N. W. winds, water may be taken under necessity only between Milwaukee and Chicago not less than 10 miles offshore.

RIVER AND LAKE ST. CLAIR AND DETROIT RIVER AND APPROACHES.

Fifteen miles above Ft. Gratiot Light to 12 miles east of Southeast Shoal lightship. With or after brisk S. W. to N. W. winds, to 25 miles east of S. E. Shoal.

LAKE ERIE.

Entire westerly end of Lake Erie to east of S. E. Shoal, as above. Pt. Abino to Buffalo. At least 6 miles off south shore and with or after S. to S. W. winds, at least 12 miles. Area south of a line drawn from Kelleys Island to 12 miles off Erie is unsafe at any time.

But, in addition to pure raw water, it is obvious that tanks should be scrupulously clean. We therefore recommend that it shall be the duty of one man on each boat to see that the tanks are cleaned each trip with soda and lye, using clean brooms or brushes, and that he alone shall have charge of filling them. All faucets in rooms should be opened to allow the solution to run

through the pipes and afterwards flushed with clean water. All tanks should be fitted with a screw plug on the outside of bottom of tank to permit of thorough drainage. All toilets aboard ship should be locked while water is being drawn for filling tanks.

All tanks should be filled through independent pieces of hose that are used exclusively for that purpose.

While these suggestions do not embrace all the things that could be recommended, the committee believes them to be sufficient for the present, and respectfully submits that they be insisted upon as a practice on the association's boats.

ICE.

Artificial ice is pure. There is much natural ice, however, which is not. To guard against contamination of meats and milk from this source, all ice should be absolutely kept in a separate compartment of the refrigerator isolated completely from the compartment containing provisions and milk. Ice should not be put in drinking water. When not taken from the tank in the ice chest, drinking water should be kept in a clean bucket or pitcher in the refrigerator to be used as desired. Manufactured ice should be purchased wherever possible.

REFRIGERATORS.

Everything must be taken out of the refrigerators and the refrigerator thoroughly sterilized every trip.

CLEANLINESS OF COOKS.

Personal cleanliness in the galley should be promoted. Stewards should be instructed to see that the provision dealer is not allowed to put supplies in the refrigerator. This must be done by his own department.

FLIES.

Flies are dangerous. They help to spread typhoid fever, dysentery, etc., by infecting exposed food and water. Every effort should be made to keep them out.

INSPECTION.

It should be the duty of the proper officer of the ship to inspect frequently the bedding on the boat to see that such bedding is sanitary and dry. Wet bed clothes are a common source not only of discomfort but of actual disease. Regular inspection should also be made of the galley, pantry, refrigerators, toilet facilities, and all rooms occupied by the crew.

In conclusion, the committee asks the active cooperation of the individual boat with the dealers to attain the objects herein set forth. While existing conditions are probably no worse than the average of other employments, the observance of these rules will nevertheless make for greater efficiency and a higher standard of morale.

THE WELFARE PLAN COMMITTEE.

By order of the board of directors

GEORGE A. MARR, *Secretary*.

LAKE CARRIERS' ASSOCIATION.

Secretary's Office, Cleveland, Ohio, May 4, 1914.

CIRCULAR No. 65.

To dealers in food supplies:

This circular is intended to direct your attention to the world-wide campaign in behalf of safety. In such a movement sanitation must, of course, play a leading part owing to the direct bearing which it has upon the health of all of us. Absolute cleanliness is the great safeguard against the spread of disease, and it is with this thought solely in mind that the welfare committee of the

262 REMEDIES FOR THE POLLUTION OF BOUNDARY WATERS.

Lake Carriers' Association is addressing to you this circular in the hope that it may enlist your cooperation in a work that must inevitably prove of great benefit to the whole country.

While the health of the men engaged in sailing the ships on the Great Lakes is probably as good as the average in other lines of employment, the opportunity is undoubtedly presented of improving the general well-being by care in the handling of food supplies and to that end a few suggestions are submitted for your consideration.

CLEANLINESS.

The term "cleanliness" really gives expression to the whole scope of this subject—clean stores and shops; clean attendants, both as to person and habits; clean receptacles; clean vehicles of delivery; clean methods of handling and transporting foods, will all accomplish the purpose of our desires.

Under this general head we would suggest that no dry sweeping be done in the storeroom or shop. More or less of the dust is merely transferred to the food.

Vermin should be eradicated.

Rats and mice should be cleaned out.

Cats, if kept, should be confined to an area where they can not come in direct contact with food.

Proper toilet facilities for employees are a necessary requisite to a well-equipped store. Care should be taken to see that they are far enough away or so located and safeguarded as to have no influence on the supplies.

FLIES.

The greatest one source of contamination of food supplies comes from flies. Typhoid germs are carried more frequently by this means than any other, and danger from this source should be reduced to a minimum.

As a means to this end no waste material should be allowed to accumulate outside of the store or in its vicinity to serve as a breeding place.

The detrimental effect of flies on meat and milk is so much greater than upon other foods that these should receive special attention and be handled in screened portions of the store.

MILK.

No milk should be supplied from sources not personally known to be of unquestioned character.

A certificate from the proper health authority should be had and obtained from every producer.

Milk should be transported in cans that have been sterilized, both inside and outside.

Distributors, after assuring themselves as to the purity of the milk furnished, should see that any delivery cans to which it may be necessary to transfer it have been thoroughly sterilized with scalding hot water, or preferably with steam.

After milk has been placed in the distributors' cans for delivery to the boat, such cans should not be exposed until transfer is made to the boat's cans.

MEATS.

Assuming that meats have been handled in a sanitary manner in the store, great care should be used in making delivery to the boat.

Every individual item on the meat order should be wrapped separately in clean wrapping paper.

If the quantity be large the basket or other receptacle should be lined with paper and all provided with dust-proof covers securely fastened.

Baskets, receptacles, and covers should be frequently cleansed.

Meat orders should be kept in refrigerators until delivery and not exposed to handling by prospective customers.

ICE.

Ice in the refrigerator should not come in contact with food supplies.

Ice furnished the boats should be that obtained from good water.

Manufactured ice is preferred and should be supplied wherever possible.

SUGAR.

Sugar should be delivered in the manufacturers' or jobbers' packages.

FRUITS AND VEGETABLES.

Fruits and vegetables should not be exposed to flies while on exhibition in the store and should be covered or otherwise protected during delivery.

In addition to the efforts that are being put forth by the owners and officers of the boats in this direction, the cooperation of the merchants and dealers is asked for in bringing about an entirely satisfactory condition governing food supplies furnished the boats.

We believe the time has come when that merchant who handles and furnishes supplies in the cleanest and most sanitary manner will win recognition for his efforts.

THE WELFARE PLAN COMMITTEE.

By order of the board of directors

GEO. A. MARE, *Secretary*.

Mr. LIVINGSTONE. I want to say one word with reference to the question which Mr. Magrath put to me this morning, and perhaps to some extent I misunderstood him. Did you mean to ask me, Mr. Magrath, if the lights and aids to navigation were entirely satisfactory?

Mr. MAGRATH. It occurred to me that I might ascertain from you, without going into the matter to any great extent, if the conditions relating to navigation on the Great Lakes were reasonably satisfactory, and if the Governments of both countries provided reasonable assistance to navigation?

Mr. LIVINGSTONE. Does that refer to aids to navigation?

Mr. MAGRATH. Yes.

Mr. LIVINGSTONE. So far as the Government is concerned and what aids to navigation we have up to the present time so far as they go, they are satisfactory, but I want to emphasize the fact and I want it clearly understood that we do not think we have all the aids to navigation that we should have. We want more. We are not complaining, because we have been treated very fairly by the Government of the United States and by the Government of Canada. When I take into consideration the immense water area controlled by the Government of Canada, and the immense calls on them, I think they have done wonderfully well. I am frank to say that. Take their relatively sparse population and the immense water area they have to control, and they have shown a spirit and disposition to do everything that could reasonably be asked of them. But with our growing commerce, which is growing by leaps and bounds, we find that what was thought sufficient to-day will be away behind to-morrow. You know the immense increase of tonnage on the Lakes. So far as we have gone, the Canadian Government and the United States Government have done a very great deal for us, and the existing aids, so far as they go, have been entirely satisfactory. It is true that we have not received as many aids as we would like, but that must always be true in a growing country. Years of experience has told us that the Canadian Government has more to take care of than we have, and not so much to do it with. I think the Canadian Government intends to build another lock at the Soo. The present lock is 60 feet wide and 900 feet in length, and when it was built we all believed that it would be sufficient for perhaps a century to come. Nineteen or 20 years after it was built we have many

boats now that can not go through that lock. A 50-foot boat is all you can put through that canal, but we have now some boats 64 feet in width and quite a number of them 60 feet in width. We made an appropriation for the Detroit River for what we call the Fighting Island Channel on the Canadian side, and I presume it is due to the sickness of Col. Lamb, the engineer, that there has been nothing done this year.

I do not mean to be understood that we have reached the end by any means, but so far as we have gone it is satisfactory. As the commerce of this country grows and as the population increases we will be constantly wanting more facilities.

MR. TAWNEY. We are very much obliged to you, Col. Livingstone.

STATEMENT OF MR. A. W. THOMPSON, MANAGER OF THE WILSON TRANSIT CO.

MR. THOMPSON. In addition to being the manager of the Wilson Transit Co. I also happen to be the chairman of the sanitary committee, which is a subcommittee of the welfare plan of the Lake Carriers' Association, which got up this circular that President Livingstone has read to you. I was just going to say, to account for my presence here, that when the notification came to Mr. Livingstone he requested the vice president, who lives in Cleveland, to send some one over here, and the vice president suggested my name as the man to come before you.

Of course, this whole proposition that you have under consideration is in direct line with what we have been planning to do for quite a long time; that is, to benefit in every way we can our sailor's mode of living, his condition, and the comforts surrounding his occupation. We started this plan within the last couple of years or so, and have been making progress gradually.

Up to the present time we have not given any consideration to this particular question of the sewage from the lake boats contaminating the water which will be used by the shore cities. We had gone into the matter of drinking water on the Lakes at quite some length, as evidenced by the circular read to you, with data which we had obtained from the Government surveys and which was largely incorporated in the circular which the president read, but the scope of your particular investigations had not, up to the present time, been given any consideration by ourselves.

THE CHAIRMAN. That is the matter of sewage disposal, either the sewage on the boat or the disposal of polluted water taken in as water ballast?

MR. THOMPSON. Well, neither proposition has been given any consideration, as a matter of fact, by our body, and I think it must be for the reason that the situation did not appeal to anybody in our particular circle as being of very vital consideration, so far as the boat's end was concerned. In the first place, it has been demonstrated by the report of the engineers of the Government that there is plenty of good raw water in the Lakes from which the boats can fill their tanks, and the disposal of the sewage on the boats would necessarily be along the whole area of the Lakes. Although I have not looked over your report very exhaustively, yet offhand it seems

to me that the subject of the contamination by the boats—the effect of the contamination of the sewage from the boats on the waters of the Lakes—has not been gone into extensively enough to furnish data upon which you could base conclusions relative to that particular subject. For instance, it would be a very easy matter to figure out the number of boats—in fact, the number of boats is known that go up and down—and you have data as to the number of passengers and also as to the number of cubic feet in the lake and the number of people that will pass a particular area in a given time. I do not pretend to know anything about this particular subject of contamination, but if you take the number of people traveling over an area of so many hundreds of millions of cubic feet of water it does not seem possible that that water could be contaminated enough to make any very great difference. I make that statement entirely on my own volition and without any expert knowledge on the subject, and am giving it to you gentlemen merely in the aspect that it appears to me and in order that you may see the operations of our minds in connection with the subject. It seems to me that that data should be presented for our benefit as laymen before any experimental matter should be taken up, so that we can thoroughly understand it.

You say that the boats contaminate the water that the cities draw from. That is a matter that is subject to proof. The contamination is there. That is already proved, but where does the contamination come from? Of course, there is this argument, that the boats at the Soo might be detained. They might be detained at various places, so that there would be quite a number of boats in a particular locality, but it would not necessarily follow that anybody would be hurt from contamination if the city did not get its water from that particular place. Boats would not take their water from that particular place, because they have already taken their water from areas where good raw water exists. There is another matter that occurred to me just at the time, and that is that there has been nothing said in this report, so far as I know, as to how soon water will rectify itself. It is known in a general way that water will clarify itself in time, and in making up data with respect to the contamination of water I think it should be stated how long it will remain so under those conditions without being added to. Water in the Lakes is subject to very violent commotion, and it receives the effect of the sun, and is more or less purified as it goes along.

The CHAIRMAN. You were speaking of the water area above and below the locks at the Soo, and if there was any contamination or pollution of the water by vessels that was injurious that the municipalities ought to change the location of their intakes. Is it not a fact that where vessels have become congested, either above or below the locks, when they are delayed, they are necessarily polluting the water which these people must depend upon for domestic and sanitary purposes?

Mr. THOMPSON. Of course, your statement is absolutely true, but the only contention I raise is this: That although the water would be contaminated there in certain instances where a congestion would become very great—it is not necessarily an often occurrence, but it does happen—if the water does become contaminated there the city should have some means of getting the water at places other than an area in which the boats would be congested in any event.

The CHAIRMAN. The riparian owners and the people of the cities have the same rights as the vessel owners to the use of that water.

Mr. THOMPSON. Of course. But you are going into the question of the legal status of it. I am talking from the matter of common sense.

The CHAIRMAN. It might be far more economical for the vessel owners to have some tank in which to retain the sewage while the vessel was being detained than it would be for the city to change the location of its intake.

Mr. THOMPSON. That may be very true. I do not dispute that. The one objection to tanks would be the quite lengthy discussion that Mr. Wright gave to them. These tanks would be subject to all kinds of weather. They would be more or less likely to damage. For instance, the rolling would more or less tend to give them a great deal of wear and tear that you would not find in a stationary plant. The natural condition would be also for them to become leaky, and their contents would be more or less liable to be scattered over the area or particular place where they happened to be.

Mr. POWELL. You thought the progress report of the commission did not touch this matter and did not show that there was much pollution due to navigation. Mr. King was of the same opinion. I wish to call the attention of the commission and yourselves to these facts: On page 29 of the progress report this statement appears:

The population upon the drainage area of Whitefish Bay, at the head of St. Marys River, is practically nil, but the lake traffic is enormous. Samples in the ship channel along the first cross section, extending from Gros Cap to a point above Bay Mills, showed the average pollution to be greater than that existing between the ship channel and the shore. Obviously, this pollution is due to boat traffic.

Mr. KING. But this is in St. Marys River. Any statement that I made was with reference to the lakes.

Mr. POWELL. But Mr. Thompson's statement was about the effect of navigation on the water generally. If you will now turn to page 80 of the progress report, you will find a more definite statement on the subject.

The pollution is general throughout the river in both channels. The fact that pollution was found to be common to both channels is of importance to summer residents, who frequently use water from this polluted river. A series of samples through Detour Passage to Mackinac Island show coliform in practically every sample (50 c. c.). This pollution is probably due to navigation, the samples being taken in the line of boat traffic.

Now, a still stronger statement is contained on page 31 of the report, and this meets your case, Mr. King:

The examination of samples in the lower end of Lake Huron showed that this water would be practically pure were it not for the pollution due to boat traffic. That portion within a radius of 3 miles from Point Edward Light showed a slight though definite pollution. The samples taken near the shore on both Canadian and United States sides gave an average of 15 B. coli per 100 cubic centimeters. The slight general pollution found within this portion of Lake Huron, while due in part to the large summer population and seasonal effects of streams, must be accounted for chiefly by the enormous boat traffic through the middle of this area.

Mr. KING. Which converges at Point Edward. The statement which you refer to has reference entirely to the 3-mile radius from Point Edward.

Mr. POWELL. Yes; but it is at the lower end of Lake Huron.

Mr. KING. That is quite true, but not in the middle of the lake.

Mr. POWELL. On page 33 there is another statement to this effect:

The cross section at the head of the river showed a slight increase in pollution over the water of the lake, probably due to the concentration of boat traffic.

At that particular point it would not come from the riparian lands. Although the examination was not conducted as thoroughly as I thought—I imagined the examination was much more extensive than was made, because the instructions were to have samples taken, and it was understood that samples would be taken, from the different boats. Now, in addition to what is here stated, there was another examination made on the boat running from Lewiston to Toronto when it got clear of the immediate effect of the waters down the Niagara River.

Mr. KING. But that was not the effect of boat pollution; that was the effect of the polluted waters of the Niagara River.

Mr. POWELL. I am excepting the polluted water of the Niagara River. They found that outside of the area of that pollution it was caused by the waters coming down the lake.

Mr. KING. Did they not find that the waters of the Niagara River had their effect on the lake for a distance of 15 or 18 miles? You say they traced the effect of sewage from the vessels? I did not notice that in the report anywhere.

Mr. POWELL. I can not put my finger on it, but it is a fact. You are familiar with that subject, Mr. Dallyn, are you not?

Mr. DALLYN. I think they did not find very definitely the effect that the boats had on it. The zone extended a little farther than any clear demarcation that was probably due to boats. The best example is in Lake St. Clair.

Mr. KING. No one would take water from Lake St. Clair unless they had to. It is a shallow lake, and it is in the center of a thickly populated district.

Col. LIVINGSTONE. Lake St. Clair is only a basin.

Mr. POWELL. If you will examine this matter carefully you will find that the pollution is in the lateral wash, and after you get out a hundred feet, where the pollution is very bad, you will find that the intake, while it does not give you water fit in its raw condition to drink, yet it is purer than it is in the lateral wash.

Col. LIVINGSTONE. Mr. Chairman, you asked me for further information as to the document that I referred to this morning as the one from which we got these areas from which we took pure water. The document is the report of Dr. McLaughlin, of the United States Public Health Service. The areas referred to are given in that progress report, beginning at page 18.

Mr. THOMPSON. I do not know, Mr. Chairman, that I have anything further to say. I just wanted to explain our position and perhaps apologize in a way for not having any recommendations to offer at this time on this particular subject. That is due to the reason I have already given you, the fact that we have not given this particular matter any thought.

The CHAIRMAN. I think, Mr. Thompson, that a study of the data which the commission has already furnished you, as well as the municipalities, will enable you to see more clearly, perhaps, than you

do now the extent to which steamboat traffic, especially on the connecting rivers, is responsible for the pollution that is complained of under this treaty.

Mr. THOMPSON. Yes; I can not deny that. It is my ignorance and my lack of information.

Mr. GLENN. What percentage of the pollution do you attribute to the boats. Some gentlemen have attributed as much as 1 per cent, some 10 per cent, and one gentleman said about one-third of 1 per cent.

Mr. THOMPSON. Offhand, I would say that outside of this congested area at occasional times, for instance, at the head of the Soo River and sometimes in the St. Clair River, my opinion would be that the pollution would not amount to more than a quarter or a half of 1 per cent. In fact, when you take into consideration that the samples have shown pure raw water in these particular lanes where the boats travel, it seems reasonable to suppose that the pollution nearer shore is practically almost entirely accounted for by the shore drainage.

Mr. GLENN. Outside of the congested area and outside of the harbors, then, you think the pollution amounts to very little?

Mr. THOMPSON. That would be my judgment. Of course, in making that statement I have a notion in my own mind—I do not know how correct it is or whether I should state it—that the water in the lake purifies itself much faster than the water along the shore and has the result of being in a better condition.

Mr. POWELL. I do not know that it purifies itself, but along the shore, where the lateral wash is, it receives the pollution from the bordering country.

Mr. THOMPSON. Continuously so.

Mr. POWELL. There is one thing that goes to support your statement, Mr. Thompson, and that is that almost every drop of water that goes into Lake Ontario is "rotten"; it is thoroughly bad.

Mr. THOMPSON. Do you mean that that pollution goes over the falls?

Mr. POWELL. Yes; it is away up to about 3,000 B. Coli to 100 cubic centimeters.

Mr. THOMPSON. Where does that come from; from Buffalo? It can not come from Detroit.

Mr. POWELL. No; Detroit does its work in Lake Erie. I was going to say that this great mass of corruption feeds Lake Ontario. There is no other water that comes from any place worth speaking of. Notwithstanding that condition, the water is pure in the center of the lake.

Mr. KING. That is my point, Mr. Powell.

Mr. POWELL. Yes; it is pure except for the pollution from your vessels.

The CHAIRMAN. Col. Livingstone, have you any other gentlemen who desire to speak to-day?

Col. LIVINGSTONE. No, sir.

The CHAIRMAN. Mr. King, have you anything further that you desire to offer?

Mr. KING. Nothing more at present. I must say that I am sure that the Lake Carriers' Association, as well as the Dominion Marine Association, will come forward at any time that the commission

desires to question us further or to submit any plans after consultation with the vessel owners. We are not attempting to stand from under to-day.

The CHAIRMAN. We are searching for light on this subject before making any final recommendations to the two Governments.

Mr. GLENN. It seems to me that you gentlemen think we have some plan already fixed in our minds.

Mr. KING. We quite realize, at least as the result of its investigation, that the commission does want information from us, and the whole effect of the discussion to-day has been to prove our ignorance and our desire not to move in ignorance, but to have a complete and thorough investigation before anything is done.

Mr. GLENN. Speaking for myself, I do not feel disposed to place upon the owners of the vessels any greater expense than is necessary to make the water pure.

Mr. KING. Might I cite a case? Until 1904, I think it was, Canadian vessels paid the cost of their annual inspection by the steamboat inspectors appointed throughout the country. We paid 8 cents a ton as an inspection fee. We asked the Government why we should do that. It was done for the benefit of the public and the public ought to pay for it. Within a month legislation went through Parliament throwing that charge upon the public funds of Canada. We submit that this is a similar case and we ask that the inspection be done automatically and at Government expense.

The CHAIRMAN. We are informed that there is a gentleman here from the State board of health or from the university at Ann Arbor. If there is any gentleman here that is interested in this subject who has information to give the commission, we should be very glad to hear from him.

STATEMENT OF MR. EDWARD D. RICH, STATE SANITARY ENGINEER, OF LANSING, MICH.

Mr. RICH. I happen to be the only representative of the State board of health present to-day. If there are any questions that I can answer I shall be glad to do so.

The CHAIRMAN. What investigation, if any, has the State Board of Health of Michigan had with respect to this subject?

Mr. RICH. Nothing more, I think, than the assistance furnished the commission by the bacteriological laboratory a year ago. That is the only direct investigation. I might say, however, in connection with what has already been brought out, that we have had called to our attention and our laboratory has made some preliminary investigation relative to the subject of chemical closets which might furnish a clue to the solution of this problem existing on shipboard. I do not see any reason why they should not be adapted to shipboard conditions, and if that were possible—and I believe it would be possible—the installation ought to be exceedingly cheap. There seems to have been considerable fear on the part of gentlemen who have already spoken that any remedy of this sort would be rather expensive. The chemical closet as installed on land is a very cheap affair. The best of them cost about \$65 apiece, and we have found by our investigations in the laboratory that they are thoroughly sanitary; that the material taken from these closets is entirely sterile.

The treatment used is a solution composed largely of caustic soda and caustic potash. There are also other forms of disinfection used for this purpose.

The CHAIRMAN. Has it any odor?

Mr. RICH. It destroys the odor. It seems to me an adaptation of this could be made to shipboard conditions very easily and would furnish a proper solution if properly worked out, but I agree that experiments ought to be made.

Mr. GLENN. Have you tried that plan?

Mr. RICH. It has been used in certain places in the State and our laboratory has tested the efficiency of it and is satisfied with the working of it.

The CHAIRMAN. How long has it been in use?

Mr. RICH. Two have been in use north of Grand Rapids for about a year.

Mr. MAGRATH. Will it take care of wash water?

Mr. RICH. No; it is not designed for a large volume of sewage. We recommend it where it can take the place of the outside privy.

Mr. GLENN. Do you think it would be practicable on board vessels?

Mr. RICH. I think it might be. I think it would be worth trying out.

Mr. GLENN. It would be at least practicable on the freight vessels.

Mr. RICH. I think it would, and especially on the tugs and yachts and boats of that sort.

Mr. GLENN. Where there are not over 20 or 21 people on board you think it would be practicable?

Mr. RICH. I think it would.

Mr. GLENN. What is your opinion of it with respect to these large steamers?

Mr. RICH. I think some modification of the plan would be necessary in cases of that kind, but the general principle might be used.

In regard to the taking on and discharge of ballast water and the rules spoken of in connection with that, it seems to me that that could be solved much more simply by treating the water as it comes into the ballast tanks with a certain amount of hypochloride, as we treat our water supplies, and then discharging it anywhere they please. That would be much better than to inflict a lot of troublesome rules on the ship companies. That could be done at a very small cost, probably not to exceed \$2 or \$3 for the cost of the chemical.

Mr. GLENN. Do you mean purifying the ballast water?

Mr. RICH. Yes; just the same as we would clarify drinking water.

Mr. GLENN. You think that could be done?

Mr. RICH. I do not see any reason why it could not be done. I think there would be some details of the operation that ought to be worked out on shipboard, but I do not think there would be anything troublesome about it at all.

Mr. POWELL. Is there anything in the chemical that would destroy the iron?

Mr. RICH. That is one of the points I had in mind when I spoke of the details of operation.

Mr. DALLYN. They have a special acid-proof preparation for use on iron. I do not think they are applicable, but you can take care of

your wash water with them. It is almost eliminated from ordinary use on shipboard. You can not use a flush closet with them.

Mr. RICH. It would seem that it ought to be possible to arrange tanks larger than are generally used and to use a small flush of the size used on railroad trains by enlarging the tank in which the material falls, and as far as the wash water is concerned I do not know but what that could be sterilized by hypochloride or some other way without storing such a large quantity of it on the vessel.

The CHAIRMAN. We are very much obliged to you, Mr. Rich, for your views. I understand that Mr. Sadler from the State university, who is conversant with ship construction, is here to-day.

Mr. SADLER. I have nothing to add, Mr. Chairman, to what has been said.

The CHAIRMAN. Are you conversant with the matters of ship construction?

Mr. SADLER. Yes, sir.

The CHAIRMAN. Have you given the subject of the treatment of sewage on board vessels any consideration in connection with the construction of vessels?

Mr. SADLER. No; I can not say that I have. Principally, I may say, I came here to-day in the expectation of getting some suggestions or information from this commission. I have not really studied the question and I would rather not say anything at the present time.

Mr. KING. I think we owe it to Prof. Sadler to explain that we asked him to be present because we thought it possible that some definite scheme involving ship construction would be brought up.

The CHAIRMAN. Let me ask you this broad general question, Prof. Sadler: In your judgment, is there anything that would interfere seriously with the construction of tanks on board vessels for the purpose of treating raw sewage before it is disposed of into the Lake waters?

Prof. SADLER. No, sir; I do not think there is. I think the main point to be considered is the practicability of the scheme. We ought to carry out thorough experiments to make sure that the thing will work after it is installed.

The CHAIRMAN. So far as the actual construction of tanks for that purpose is concerned, you do not see anything to interfere with them?

Prof. SADLER. Without having any definite data upon which to base my statement, I would say that I do not see that there is anything material that would interfere.

(The commission thereupon, at 4 o'clock p. m., went into executive session.)

DETROIT, *Wednesday, November 11, 1914.*

The commission met at 10 o'clock a. m.

The CHAIRMAN. Gentlemen, I understand that the officials from the Canadian Soo have not yet arrived, and we will, therefore, proceed at this time by hearing the representatives from the United States side of the Soo. What gentlemen are present who desire to be heard?

(Mr. Sherman T. Handy, mayor of Sault Ste. Marie, Mich.; and Mr. C. H. McIlhargie, city engineer of Sault Ste. Marie, Mich., announced their appearance.)

STATEMENT OF MR. SHERMAN T. HANDY, MAYOR OF SAULT STE. MARIE, MICH.

Mr. HANDY. So far as the details of the sewerage system is concerned, I am going to leave that entirely to Mr. McIlhargie, the city engineer, who has a map showing the system and the outlets. I take it that you are interested in remedying the pollution of the water between the two countries. That there is pollution there can be no question. That the pollution injures anybody we think is a subject of considerable argument. We think it does not injure anybody. The water supply of the city of Sault Ste. Marie, Mich., is received above a rapids, a distance of about three miles and a half. The sewage is all emptied into the St. Mary's River below the rapids. Consequently, pollution in the water which we drink could not in any manner or shape be traceable to our sewage. If the water which we drink is polluted, that pollution must come from some other sources. As I say, our intake is about $3\frac{1}{2}$ miles above the rapids.

The CHAIRMAN. Mr. Handy, is there any municipality on the Canadian side or on the American side above your intake where sewage in its raw state is deposited in the lake?

Mr. HANDY. No, sir.

The CHAIRMAN. From what other source could the pollution that you say exists come?

Mr. HANDY. I do not think there could be any question but what the pollution comes from the boat traffic.

The CHAIRMAN. What are the conditions in connection with the boat traffic above or in the vicinity of your intake?

Mr. HANDY. The principal thing is this, that at certain times in the year, during a frost or severe storm, a large number of boats are at anchor above and below the locks.

The CHAIRMAN. For what length of time do they remain there?

Mr. HANDY. They have remained there all the way from one day to a week, very seldom, however. They anchor up as far as the intake, sometimes a little above it.

The CHAIRMAN. How many vessels have been known to be congested there at any one time?

Mr. HANDY. I would hate to give the exact number, but it oftentimes looked as though there might be in the neighborhood of 50. They have been tied up there for weeks. That condition existed during the bad storms of a year ago and often exists in the spring when the ice is not out of the lake above the rapids. They go up and lie there and wait for the ice to open, and, oftentimes, when they are coming down, they wait for the ice to get out of Hay Lake and Mud Lake. Consequently, they are at anchor there sometimes for a week.

So far as our water supply is concerned, there is only one of two things to do to avoid the pollution coming from the boats, and that would be to require them not to empty any of their refuse in the lake while lying at anchor or require us to put our intake at some other place. I do not know where else we could put our intake.

We installed a new waterworks system there a few years ago at a very large expense to the city and selected the best place that we thought could be had that was safest from pollution.

The CHAIRMAN. What evidence have you that your drinking water is polluted now?

Mr. HANDY. The United States officials have reported that is polluted. We have our water analyzed at Lansing on an average of about once a month at least, and there have been a few times when they have reported pollution in the water. I can remember only one time, however, in a period of a great number of years when the health officer recommended that the water be boiled, and that was in the spring of the year, when boats were tied up there.

Mr. GLENN. Do you treat your water at all?

Mr. HANDY. No; not at all. Our water, according to the report, is A1; that is, it is considered as good water as there is in the State of Michigan coming from Lake Superior. I saw a report from the health officer within the last three weeks, and it was stated that there was no dangerous substance in the water whatever. Of course, if a boat should lie at anchor and water should be taken at that particular time, there would be pollution in it necessarily. I regret that I was not present yesterday. Had I known that there was to be a hearing on the boat-traffic question I would have been pleased to have been here.

I believe that were it not for the pollution which comes from the discharge of refuse from the boats that we would have water that would hardly be surpassed anywhere.

I want to take up for a few moments the question of changing our sewerage system, which has five outlets, as I remember it, into the St. Marys River. I want first to go back, however, and give you a little history of the city and its conditions. The city of Sault Ste. Marie was incorporated by a special act of the legislature in 1887. At that time the new artificial canal was being constructed for the purpose of utilizing the water and generating power in the new power plant. Under the overmastering and magnetic influence of Mr. Clergue the people of Sault Ste. Marie dreamed that it was only a matter of a very short time when Sault Ste. Marie would be the metropolis of Michigan. They started to build with that idea in view. The city of Sault Ste. Marie, according to the last census, had a population of 12,635. It has over 14 square miles. It is over 6 miles running east and west and about 3 miles north and south. To build the artificial waterway it became necessary, of course, to build a great many bridges. In other words, driving on the streets running north and south was entirely cut off for a distance of about 2 or 3 miles. The city gave them the right of way freely. The only thing they asked the company to do in consideration of giving up the streets was that they would furnish a trunk sewer on the south side of the canal sufficient for the emptying of the sewage of the south side of the city into it. We have 6 steel bridges across the canal, 240 and 270 span bridges, with no abutments. Consequently they are expensive bridges.

Those six bridges cost the city approximately \$100,000. They cost the city every year approximately \$3,000 to maintain, because on

account of the long spans we can only put plank on them, and they have to be resurfaced every two years, at least, and sometimes oftener, and they have also to be painted. It is a big burden. I only mention this for the purpose of showing you some of the reasons for our large bonded indebtedness. Our assessed valuation of the city is \$7,000,000, in round numbers. The constitution of the State of Michigan recently adopted, in 1907, provided that the legislature should enact a law fixing a uniform and a maximum rate of borrowing power of municipalities. That was fixed at 8 per cent of the assessed valuation. That would give us a borrowing power of \$560,000. At that time we had a bonded indebtedness of over \$700,000. We have that much now. We can not increase it, because that would be violating the State law. We pay an interest debt every year of approximately \$30,000. Under our charter we can only raise by taxation 2 per cent of our valuation, or \$140,000. Our area is so large that we have a great many miles of streets, and since the 1st day of May we have expended upon the streets in the neighborhood of \$35,000. I say to you, gentlemen, that by raising our entire limit under our present authority we can barely get along and meet expenses. Now, I am not giving you a hard-luck story of the city of Sault Ste. Marie. The people of the Soo, including myself, are very optimistic. We believe, now that you have settled the water-power proposition there, both cities are going to grow and prosper and we are going to have better times; but we could not bond for another dollar if we wanted to, and we are therefore handicapped, so far as making any change in our present system is concerned.

Without criticizing or reflecting in any way upon the systems of any other city, I realize that we are in a different position than the cities of Detroit, Windsor, Port Huron, or Sarnia for this reason, that we have not a village or city on the St. Marys River below the Soos which use water from the St. Marys River; that is, there is no water system. The people along the shore down there may use the water, but there is very little of that. They get wells very easily, and there is very little water taken from the St. Marys River. Consequently any pollution of the water on account of the sewage being emptied in there—and I admit that there is pollution—could not in any way injure or affect anybody. The city of Sault Ste. Marie, Ontario, and the city of Sault Ste. Marie, Mich., are opposite each other, and have the current of the river running between them. I do not claim to be an expert or to know anything about the operation of the sewage going into the river, but with the current that exists there, which is necessarily more than it used to be on account of the narrowing of the rapids, I can not see how our sewage could cross that current and affect the Canadian Soo in any shape or form. And I can not see, and I do not believe, that the sewage from the Canadian Soo affects us one iota. It could not, because our water intake is above anyway. Within a mile and a half of the outlet of our sewage system we are entirely within the State of Michigan. We go into what is known as "the Little Rapids Cut," which is totally and wholly within the State of Michigan and in which there is a very swift current. From there to Detour there is not a village nor a municipality of any kind that takes water from the St. Marys River on either side.

Mr. GLENN. How far is that?

Mr. HANDY. That is a distance of approximately 50 miles. When you pass Detour, of course, you get into Lake Huron, and you would have to go to Alpena before you would strike a city in which the waters can in any way mingle. I can hardly believe that any sewage emptied into the St. Marys River at the Soo could injure anybody down on Lake Huron.

The CHAIRMAN. There is no municipality on the Canadian side below on the St. Marys River, is there?

Mr. HANDY. None whatever.

The CHAIRMAN. Are there summer residents there?

Mr. HANDY. There are some on the islands.

The CHAIRMAN. On the Canadian side?

Mr. HANDY. Well, down on St. Joseph Island, which is about 25 miles down the river. There is also on Neebish Island, on the Michigan side, what is known as the encampment, and there are some people there.

The CHAIRMAN. I am inquiring particularly about the Canadian side.

Mr. HANDY. On the Canadian side, across from the encampment, is St. Joseph Island, and some summer residents go there.

The CHAIRMAN. Do they get their water from the river?

Mr. HANDY. I think not. Speaking with reference to the people on the Michigan side, I would say that they use well water. There would be no one using water from the river unless it might be some people from the Soo, who would go down there to camp for a day or two and have no means of getting water except by taking it from the river.

Now, I have given you our position, the condition of our city, a statement with reference to the conditions under which we obtain our water, our sewage outlet, and our inability to put in a plant which would treat it as it ought to be treated provided that sewage was an injury to anybody. If there are any questions that the commission desires to ask, I shall be glad to answer them if I can.

Mr. GLENN. Is there any way in which you can increase your bonded indebtedness under the laws of Michigan?

Mr. HANDY. No.

Mr. GLENN. Can not you do it by submitting it to a vote of the people?

Mr. HANDY. No. The legislature has passed a general law.

Mr. GLENN. Some of the States have general laws, but if they want to exceed the limit they are allowed to do it by submitting the proposition to the vote of the people. It is so in my State.

Mr. HANDY. That is not true here; but even if it were true, and even if there were no limitation whatever, and we were required to incur an additional burden of several hundred thousand dollars in order to treat this matter as it should be treated scientifically, it would place such a burden upon us that we could not carry it.

Mr. GLENN. You say you have five outlets?

Mr. HANDY. I am informed by the engineer that we have seven. He will tell you more particularly about that.

Mr. GLENN. Could they not all be emptied into a connecting sewer and the sewage thus treated?

Mr. HANDY. I presume that they could, yes; but the cost of treating is something that I know nothing whatever about. As to what

a plan of that kind would cost, I do not know; but it seems to me that even though conditions might arise in the future that would require it, I fail to see where anybody is particularly injured, especially at the present time.

The CHAIRMAN. Have you had any considerable number of cases of typhoid fever in your city?

Mr. HANDY. We have not had an epidemic. We have had some typhoid. We have a marine surgeon there at the Soo, and there are a lot of people that come off the boats and go there with typhoid. What the rate is for our own people I am not prepared to say.

The CHAIRMAN. Has there been any complaint on the part of the board of health or the local physicians with respect to the water being polluted near the intake to such an extent that it would produce typhoid fever?

Mr. HANDY. None whatever. I think we have as good a health officer as there is in the State of Michigan. He has devoted practically his entire time to the interest of the city, and he might be termed an extremist on health. He is continually working for a cleaner city, and I have gone up with him to the pumping station and talked with him almost daily. He is extremely loud in his praise of the water that we get there. He says that were it not for the boats there would be no better water anywhere.

The CHAIRMAN. Has he complained about the discharge of raw sewage by the boats in the vicinity of the intake?

Mr. HANDY. Yes; he complained about that. He says he can not see how that can be changed unless the boats would withhold the dumping of their sewage until they passed through.

Mr. KLUTZ. Mr. Chairman, just by way of keeping the record straight, I would like to call attention to the fact that in the letter of October 10 last, which I wrote Mr. Handy notifying him of this meeting, I also mentioned the fact that the lake carriers would be heard here yesterday on the subject of pollution.

STATEMENT OF MR. C. H. McILHARGIE, CITY ENGINEER OF SAULT STE. MARIE, MICH.

Mr. McILHARGIE. Mr. Chairman and gentlemen, Mr. Handy, our mayor, has gone into various phases of our condition. That would leave to me a discussion of our system. We use a combined system of sewerage, with dilution as a final disposal. While we agree that purification of sewage is an ideal condition, conditions are not at this time ripe for the adoption of it with respect to our town. We have seven outlets into the St. Marys River, beginning below the locks with the original sewer outlet and following down to perhaps a quarter or a half a mile above the Little Rapids. Our town is divided into two parts by a water-power canal. That necessitated some change in the sewerage system, and divided in that particular way would make segregation of our sewage to one common disposal plant a necessary and an expensive proposition. We believe that disposal by dilution into the St. Marys River is a natural resource and under our conditions is justifiable. I am not an authority on sewage disposal and do not claim to be, but the question of disposal other than disposal by dilution has never been considered at the Soo. I want to state at this time that questions of pollution

would arise in case of typhoid fever in our town. We have an occasional case—that is, of local infection—but a vast percentage of our typhoid is not from local infection. We have no statistics, however, as proof of that. But that being so, a comparison of our mortality with respect to typhoid on a basis of a hundred thousand population seems to me not to be fair to a town of our size, because with a large percentage of outside infection the percentage would not be increased proportionately with the population as between twelve or thirteen thousand and a hundred thousand.

Now, we further believe, with respect to the treatment of sewage, that we are not, and we know that we are not, in a financial position to construct a disposal plant at the present time. Our tax rate for this year is \$32.57 per thousand. Our mayor has stated our bonded indebtedness and the various other propositions.

With respect to our intake, I would say that some years ago we had an original intake and took water from the United States ship canal which was located near the international bridge. At that time, which was before my time in the Soo, I understand that they had considerable typhoid fever, but the system was changed and the intake moved to Big Point, which is about $3\frac{1}{2}$ miles upstream. Since that time we have had no epidemics.

The CHAIRMAN. Have you had any considerable number of cases of intestinal troubles?

Mr. McILHARGIE. Not that I have knowledge of.

The CHAIRMAN. What do you know with regard to the conditions in the vicinity of your intake with respect to vessels lying there for any considerable time and discharging sewage into the river?

Mr. McILHARGIE. The intake is located at a point in the channel in 42 feet of water. There is 30 feet of water over the crib. The chances for pollution are remote except for congested vessels—that is, if there were a number of vessels anchored there for some little period. I can not see where we could get pollution from the watershed from either side. It seems from investigations that we have made that our only source of pollution would be from the refuse from the boats, and that is remote. The velocity of indraft there is less than the velocity of the river, which assists us further.

The CHAIRMAN. There are no rivers coming in above the intake that drain any considerable areas, are there?

Mr. McILHARGIE. There are some rivers up some distance, but they drain wooded tracts and some rural land.

The CHAIRMAN. How far above the intake are they?

Mr. McILHARGIE. The Whiskey River outlets at Bay Mills. It is about 16 miles, and the Paquamina River is farther up. It drains a considerable territory.

Mr. GLENN. What would it cost to have a sewer connecting all those sewers?

Mr. McILHARGIE. I am not prepared to say. I have not had time enough to go into that feature of it. It would cost somewhere between \$200,000 and \$400,000.

Mr. GLENN. What do you think of the condition of the cities below you after the raw sewage is emptied into the river?

Mr. McILHARGIE. There are no intakes below us. The population during the summer time is not a large one. I think the quantity

of our sewage is so small as compared with the flow of water that it is fairly well diluted when it reaches those people.

The CHAIRMAN. Is there an intake within 60 miles of where your sewage is discharged into the river?

Mr. McILHARGIE. There is not.

Mr. GLENN. What is the population of those islands?

Mr. McILHARGIE. I do not know; but they are sparsely populated.

Mr. GLENN. Is that the place where the State guard meets?

Mr. McILHARGIE. No; not our State guard.

Mr. GLENN. What kind of an encampment is it that you spoke of?

Mr. McILHARGIE. That is called the Sailors' Encampment. I do not know where it receives its name.

The CHAIRMAN. The population on the islands is entirely a summer population, is it not?

Mr. McILHARGIE. So far as the shores are concerned. There a few farmers on those islands, but the population is mainly summer residents.

Mr. POWELL. What about your putting your raw sewage into the river injuring the river life below?

Mr. McILHARGIE. We do not believe we are injuring anyone below.

Mr. POWELL. I am speaking about the vessels.

Mr. McILHARGIE. That would interfere with them.

Mr. POWELL. Would it be practicable to construct an intercepting sewer to take all this sewage that runs down the river?

Mr. McILHARGIE. I do not know. I have not given it study enough to say, but I do not think it would be practicable to segregate the whole of them, as we are cut in two by the canal.

Mr. POWELL. The country there is quite level, is it not?

Mr. McILHARGIE. Part of it is level. We have some high land, and we have all classes of soil from quicksand to solid rock.

Mr. POWELL. Immediately along the back shore it is comparatively level, is it not?

Mr. McILHARGIE. It is; but the land would be difficult to get for anything. The United States Government owns a considerable portion of it and then the power canal cuts off a portion at that point. It would be difficult for us to get land on the island on which to treat our sewage. I would state that we have a small system outletting directly into the water-power canal. We have three storm-water overflows from our combined sewerage system into the canal at other points, and the flow in the canal will range from 1,200 cubic feet to a maximum of 30,000 cubic feet per second.

I wanted to say also with respect to pollution that it seems to me the taking of water ballast by the steamboats in the harbors that are polluted and dumping them promiscuously into the waters might have a polluting effect.

The CHAIRMAN. Do you know of any vessels discharging their water ballast above the locks in the vicinity of your intake?

Mr. McILHARGIE. I do not.

Mr. POWELL. They chiefly touch the Soo or reach points farther up the lake? It is not a point of destination, to any great extent; it is simply a place to call?

Mr. McILHARGIE. That is correct.

Mr. POWELL. You publish your civic accounts annually, do you not?

Mr. McILHARGIE. They are published in printed form.

Mr. POWELL. And that printed pamphlet gives the city debt and the taxation, etc.?

Mr. McILHARGIE. It does.

Mr. POWELL. Could you supply us with a few copies?

Mr. McILHARGIE. We can.

Mr. HANDY. We would be very glad to send you a couple of copies of our comptroller's statement that he is required to make annually.

The CHAIRMAN. We would appreciate it if you would send copies to each of the secretaries of the commission, one at Ottawa and one at Washington.

STATEMENT OF MR. THOMAS EDWARD SIMPSON, MAYOR OF SAULT STE. MARIE, ONTARIO.

Mr. SIMPSON. Mr. Chairman and gentlemen, I wish to state that I expected the engineer or the manager of the water and light systems to have been here this morning to give you the main facts in connection with the conditions as they exist in Sault Ste. Marie, Ontario, but unfortunately the train is very late on which he is coming and he has not yet arrived. I may say that I have heard the statement of Mr. Handy, of Sault Ste. Marie, Mich., and the conditions existing on the Canadian side are very similar to those existing on the American side. The sewage of Sault Ste. Marie, Ontario, is disposed of in St. Mary's River in its raw state. The outlets are all below the ship canal. The intake is above all of the sewer outlets but not above the rapids. The intake is in the hydraulic power canal, just above the head gates, and the water has been contaminated for some little time; in fact, the water at the present time is being chlorinated.

Mr. POWELL. You chlorinate your water?

Mr. SIMPSON. Yes, sir.

The CHAIRMAN. How long has it been necessary to chlorinate the water?

Mr. SIMPSON. We were ordered by the provincial board of health to chlorinate the water about the middle of last summer—1913.

The CHAIRMAN. Is that order of the provincial council in consequence of any typhoid-fever epidemic?

Mr. SIMPSON. Yes, sir; there was more typhoid than usual at that particular time, and it was attributed to the water conditions, and as a result the water had to be chlorinated.

The CHAIRMAN. Where did the health officials, either of the city or of the Province, claim the pollution came from?

Mr. SIMPSON. The contention is that the pollution is mainly from the boats that are passing up through the canals.

The CHAIRMAN. Is there any surface drainage coming in above the intake that would have a tendency to pollute the water at the intake?

Mr. SIMPSON. There is one small stream coming in probably three-quarters of a mile above the intake, but it is not passing through a thickly populated section of the country; in fact, the country is very sparsely settled where that stream is coming through before it reaches the river. The steel plant is above the intake, but their main sewer comes down through the city and the outlet is below the intake.

The CHAIRMAN. The outlet of the sewers from the steel plant, you say, is below the water intake of Sault Ste. Marie, Ontario?

Mr. SIMPSON. Yes, sir. During the past few years—up until quite recently, in fact, when the new lock was opened on the American side—practically all of the large boats passed through the Canadian canal or the Canadian lock. That naturally necessitated these boats having to lie and await their turn, in many instances, and lying at the piers up above the locks. Any sewage that was allowed to escape from those boats into the river there would naturally have an opportunity to work down toward our intake.

The CHAIRMAN. How far above your intake do the boats lie?

Mr. SIMPSON. About half a mile along the pier—not more than half a mile.

The CHAIRMAN. How long do the boats stay there?

Mr. SIMPSON. Possibly from 15 minutes to an hour; just awaiting their turn in passing through; but during the season of navigation, when navigation is at its height, there are boats lying there almost constantly awaiting their turn to lock through. Those conditions will be altered very materially, now that the new lock has been opened on the American side, which is a larger and deeper lock than the one on the Canadian side. There is no municipality or town or city below Sault Ste. Marie, Ontario, that is taking water from the St. Marys River on the Canadian side. The country is very sparsely settled. There are very few campers who summer down below the city of Sault Ste. Marie. Many of them go above, in fact; but those settlers who do reside below the city of Sault Ste. Marie invariably get their water supply from wells. Down on St. Josephs Island, which is probably 35 miles distant, they use wells for their water supply. They are largely a farming community.

The CHAIRMAN. I assume the farmers all use wells, too, do they not?

Mr. SIMPSON. Yes, sir.

Mr. GLENN. What is your population?

Mr. SIMPSON. The population of the Soo was 12,100 at the last census. The town of Steelton, which adjoins the city of Sault Ste. Marie, has a population of between five and six thousand on the Canadian side.

Mr. MAGRATH. Is that above you?

Mr. SIMPSON. Yes; that is above us. The sewage of the town of Steelton is disposed of into the river and the outlet is below the water intake of the city of Sault Ste. Marie.

Mr. MAGRATH. That is, before it enters into the canal?

Mr. SIMPSON. Yes, sir; below the entrance to the canal.

The CHAIRMAN. What is the bonded indebtedness of your city?

Mr. SIMPSON. A little over a million dollars; about a million and two hundred and some odd thousand.

The CHAIRMAN. What is the limit of indebtedness that you may incur under your law?

Mr. SIMPSON. I am not sure, but I think it is 10 per cent of the assessed valuation.

Mr. MAGRATH. Are you living up to the requirements of the health department in connection with your water supply?

Mr. SIMPSON. Yes, sir.

Mr. MAGRATH. Have you no trouble?

Mr. SIMPSON. We have met the requirements of the provincial board of health in every instance.

Mr. MAGRATH. Are they fairly aggressive in looking after you?

Mr. SIMPSON. They are quite aggressive, sir.

The CHAIRMAN. Have you had any complaint from the citizens on account of the effect of the chlorination of the water?

Mr. SIMPSON. We have had considerable objection as to the unpleasant taste at times, and we even go so far at times as to say that the odor from it is very nauseating. I do not know whether the effects are injurious at all.

Mr. MAGRATH. Have you in contemplation any plans for improving your system?

Mr. SIMPSON. To make that clear I might just explain that the water and light system was owned and operated by the Tagona Water & Light Co., a subsidiary company of the Lake Superior corporation, until October of this year, when it was assumed by the city. Since that time we have been experimenting on drilling for artesian wells. The town of Steelton, adjoining us, has been successful in getting a supply of water quite sufficient for their requirements from artesian wells. We are at present experimenting on that to see whether it will be possible to secure a sufficient supply for the city. It has not been proven as yet whether or not that is feasible. Failing in that, we contemplate working out some other means of purifying the water by mechanical filtration, or something of that nature. The provincial board of health have notified us that we would not be permitted to take water from the St. Marys River without treating it unless we go up to the entrance of Lake Superior, which is up above Gros Cap, the cost of which would be about \$800,000.

Mr. MAGRATH. How far is that?

Mr. SIMPSON. About 18 miles.

Mr. MAGRATH. Do they seriously expect you to go up there?

Mr. SIMPSON. Well, they intimate that that is the nearest location at which they would approve of the water being used without treatment.

Mr. MAGRATH. Do they ever say anything about your treating your sewage?

Mr. SIMPSON. No, sir. The provincial board of health has approved of our sewage outlet. Anything that has gone in during recent years has been submitted to the provincial board of health and has been approved before being put in.

Mr. POWELL. How do you chlorinate the water? Have you any system of providing a proper proportion of the chlorine to be injected into the water?

Mr. SIMPSON. Yes. I am sorry that I do not feel competent to explain that clearly to you. That is one of the phases that I would like to have had the manager of the water and light department explain to you.

Mr. POWELL. Have you mixers that mix a certain quantity?

Mr. SIMPSON. It is prepared in large vats and is allowed to enter into the water supply through an orifice box. The opening is congested according to the pumpage of water, and there is a man watching that all the time to regulate it. It is his duty to watch the pumpage and administer the chlorine.

Mr. POWELL. Is it regulated automatically?

Mr. SIMPSON. No; there is a man to look after it. The other phase that I was going to mention was the one pertaining to the financial condition. Having assumed the water and light systems, the initial cost of which is practically a half million dollars—between \$453,000 and \$454,000, to be accurate—that is a pretty heavy obligation on the city at the present time owing to the present financial conditions that exist. Those systems are not as yet paid for. Debentures have not as yet been sold by which we hope to raise the money to pay for the system, and in addition to paying for the systems as they now exist we have to probably put in a filtration plant, or if we get the artesian wells the cost will be quite considerable in having the system changed to get our supply there. We also have to install a new pumping station for the city's requirements. In addition to the ordinary municipality's requirements, this is going to prove a pretty severe tax on the borrowing capacity of the city, and if we were asked to treat our sewage, it would mean quite an outlay at least. I am afraid it would be almost impossible for us to get the money with which to do it.

The CHAIRMAN. What is the width, approximately, of the St. Marys River below the falls?

Mr. SIMPSON. About a mile and a half.

Mr. HANDY. Do you mean right at the foot of the rapids?

The CHAIRMAN. I mean from there down.

Mr. HANDY. For about a mile, I should say, that it would be nearer three-quarters of a mile than half a mile from shore to shore.

Mr. GLENN. Is the current there rapid?

Mr. HANDY. Yes; there is a rapid current.

The CHAIRMAN. Now, below that.

Mr. HANDY. From there the river divides, a part of it going down through the ship canal cut and the other going the Georgian Bay route—the old route. There, of course, the current is not so great, but since the Government has made that cut through there all the ships go down that way and the current is quite rapid.

Mr. MAGRATH. I gather, Mr. Simpson, that you have no complaint to make against any other municipality with respect to polluting the water?

Mr. SIMPSON. No, sir; there is no pollution from any municipality affecting our city.

Mr. POWELL. But you do make complaint against the vessels?

Mr. SIMPSON. Yes, sir; it is quite evident from the reports that have been submitted to us by our provincial board of health and by our local board of health that the water is being contaminated by the vessels.

Mr. POWELL. Does the action of the wind where your water intake is ever counteract the current and send the water upstream?

Mr. SIMPSON. No, sir. In the hydraulic power canal the current is quite rapid.

Mr. HANDY. I would like to say one word in corroboration of Mr. Simpson's statement, that for a number of years on account of the draft in the American locks the large boats—boats drawing 19 feet or over—have taken to the Canadian locks, and they are all anxious, of course, to carry as much as they can, and the result is that there has been a lot of them that have been tied up there waiting to get

through. That condition will be relieved, however, since the new lock on the American side is opened.

The CHAIRMAN. Will it be entirely relieved?

Mr. HANDY. I should say pretty nearly so.

The CHAIRMAN. Will there be any necessity hereafter, under ordinary circumstances, for congestion of steamboats above the locks?

Mr. HANDY. I can not see any, except in cases of fog, rough weather, or ice.

The CHAIRMAN. In case of rough weather do they go through the locks and then remain there?

Mr. HANDY. They remain at anchor until the weather conditions are right for them to go out into the lake.

The CHAIRMAN. What is the occasion for congestion of vessels at the lower end of the locks?

Mr. HANDY. If they are boats that are going down there is no particular reason except in the springtime, when they can not get down through Hay Lake or Mud Lake—that is, where the ice is thick.

Mr. POWELL. You do not chlorinate the water on your side?

Mr. HANDY. No, sir; there is no treatment whatever.

The CHAIRMAN. Well, gentlemen, that concludes the hearing, unless there is some one else who desires to be heard.

Mr. SIMPSON. The engineer is coming on the train that was due here at 7.45 this morning. Possibly there are some questions that you would like to ask him?

Mr. GLENN. How late is that train?

Mr. SIMPSON. When I telephoned the hotel a few moments ago they thought the train was in.

Mr. GLENN. What information has he that you have not already given us, Mr. Mayor?

Mr. SIMPSON. Well, he can give you much more clearly the information as to the matter of treatment.

Mr. HANDY. Mr. Chairman, I would suggest that if he does not arrive before you adjourn your morning session he might address a communication to the commission setting up the facts, and that communication could be considered as a part of the record and as having been given here.

The CHAIRMAN. That would be entirely satisfactory to the commission.

Mr. MAGRATH. Supposing we allowed him to submit a statement in writing, Mr. Simpson, would that be satisfactory?

Mr. SIMPSON. Yes; that would be satisfactory, if agreeable to the commission. I do not want to disarrange your program, and his statement could be submitted in writing if you would prefer to have it that way.

Mr. POWELL. This town lying above Sault Ste. Marie on the Canadian side that you spoke of is a corporation, is it not?

Mr. SIMPSON. Yes, sir; it is an incorporated town.

Mr. POWELL. Does it publish annual statements of its financial condition?

Mr. SIMPSON. Yes, sir. The clerk of the town of Steelton is Mr. J. Robinson.

(As requested by Mayor Simpson and leave granted, Mr. A. E. Pickering, manager of the city water and light department of Sault Ste. Marie, Ontario, submitted a written statement.)

284 REMEDIES FOR THE POLLUTION OF BOUNDARY WATERS.

STATEMENT OF MR. A. E. PICKERING.

NOVEMBER 14, 1914.

To the International Joint Commission.

GENTLEMEN: I regret that on account of my train arriving several hours late in Detroit I was unable to be present at the conference held on the morning of the 11th instant. I understand from Mayor T. E. Simpson that he gave testimony with reference to the financial conditions of the city, which would be seriously affected by any immediate expenditures which might be required should a decision be reached to be put into effect some method of treatment of raw sewage before discharging same into the river. I can only add that even the simplest allowable method of sewage treatment as referred to in paragraph 8 of the *Résumé of Testimony of Consulting Sanitary Engineers* given at the conference in New York on May 26-27, 1914, would entail a very considerable expenditure here on account of the fact that there are nine different outlets distributed along the shore of the river for a distance of approximately 2 miles.

Referring further to the testimony of the consulting sanitary experts, paragraph 4, and considering in connection therewith the progress report of the International Joint Commission, dated February 16, 1914, it would appear that the dilution under existing conditions due to the very large flow in the river is sufficient to take care of the present pollution due to sewage, as the average tests taken at the section in the river immediately below the two Soos shows the B. Coll per 100 c. c. to be considerably below 500. It was also further agreed by the consulting sanitary experts that, generally speaking, the raw water in the river would be unsafe for domestic use without purification due to the ordinary drainage from rural communities, etc., and the discharge from storm sewers, so that considering the local conditions in the St. Marys River the extra pollution, as now exists, due to the discharge of sewage at the various outlets, does not further seriously affect the waters downstream for use in other communities, summer resorts, etc.

In regard to the present water supply for Soo, Ontario, which is taken at a point above the rapids and upstream from all sewer outlets, the progress report above referred to would indicate that the pollution affecting same is due very largely to the sewage discharge from boats. The fact that the pollution is greater at the intake on the Canadian side than on the American side would strengthen this assumption in that our intake is more directly in the path of boats entering the locks, consequently rendering the water supply more susceptible to concentrated infection.

On instructions from the provincial board of health a chlorination plant was installed in August, 1913, which has been operated to date, and a dosage maintained at 5 parts available chlorine to 1,000,000 parts of water. Recently the city has been making tests in an endeavor to locate an underground source of water supply. These have not been completed to date, but the adjacent town of Steelton has been successful in procuring an underground supply of pure water, which, at present, seems to be ample to meet their requirements.

Yours, respectfully,

A. E. PICKERING, *Manager.*

(At the close of the hearing Mr. John B. Waterfall, of Detroit, appeared, and was requested to submit his views in writing.)

STATEMENT OF MR. JOHN B. WATERFALL.

To the Hon. JAMES A. TAWNEY,

President International Commission of the Great Lakes Water Supply:

As you requested me to send in a paper on the best method of preventing the contamination of the water supply by our steamers and the vessels of our Great Lakes, I will say, first, that all sewerage from closets and sinks ought to be driven by gravity to a sterilizing plant as the best method and sanitary way for the health of the public at large. All garbage from steamers should be incinerated and nothing thrown into the Lakes, as they now do from passenger steamers, which forms a floatage along the shore.

The drinking water ought to be drawn from the areas of the deep waters of the Lakes and not the River St. Clair, or Detroit River, or Lake St. Clair, which are so shallow, and all the water let out of the ballast compartments ought to

be dumped into the deep waters away from intake pipes or the supply near our large cities.

As an old lighthouse boulder in the building of cribs and range lights on the open lakes, I would say that Lake Superior, the great reservoir of all the Lakes, is not contaminated by only the Portage Lake Canal where the dumpage of the stamp mills has made the water a deep red, and also the water pumped up from the copper mines of Keweenaw and Houghton Counties and the Soo River by the industries at both the Canadian and American Soo. The lower end of Lake Michigan is by quite a current drawn into the Chicago River over the Bear Dam to the Illinois River, into the Mississippi River. All the cities north of Chicago on Lake Michigan are by the slow current of the Lake drawn up to the Straits of Mackinac. Lake Huron, Saginaw, and Bay City and all the cities on Lake Huron are drained into the Lake to Point Edward where it enters St. Clair River and the towns on each side are drained by the St. Clair River to the St. Clair Flats where the water is shallow and there is more contamination from summer resorts. And then the St. Clair Canal is a channel for the drift of all the dumpage of the flats, so the shallow waters of Lake St. Clair so open to sunlight and aeration that it is improved somewhat before it gets to the Detroit River.

In my report to Mayor H. S. Pingree I recommended that the Detroit intake water pipe to be extended to the Canadian channel so deep and clear, and it would be exempt from the drift of Connors and Fox Creeks as it is now on the American side. Detroit River ebbs and flows by the wind up and down Lake Erie, for the fall up the river from St. Clair Lake is only 3 feet on 20 miles to Lake Erie—only 3 miles an hour of a normal current. The water rises at Detroit sometimes from 1 to 3 feet and the current at times is only $1\frac{1}{2}$ miles per hour, backing up the sewerage from Detroit River up toward the intake pipe in the spring freshets.

I attach a part of my report on the water supply to show you the handicap of the many things that tend to contaminate our water supply.

When the prevailing wind blows up Lake Erie it raises the water in the Detroit River from 1 to 2 feet above normal, which is only $1\frac{1}{2}$ miles per hour from the Horse Shoe Bend in the river to Ballard's Reef. United State engineers told me they have seen drift ice flowing upstream in the early springtime.

Respectfully, yours,

JOHN B. WATERFALL,
*Expert Investigator of the Detroit Water Supply under
Ex-Mayor Pingree, No. 33 Columbia Street, East.*

There being no one else to appear before the commission, the hearings were closed and the commission adjourned.

INTERNATIONAL JOINT COMMISSION,
Washington, D. C., Monday, December 14, 1914.

The International Joint Commission met at Washington, D. C., Monday, December 14, 1914, in pursuance of the consideration of the reference in relation to the pollution of boundary waters.

Present: Obadiah Gardner (presiding); Henry A. Powell, K. C.; James A. Tawney; Charles A. Magrath; R. B. Glenn; and P. B. Mignault, K. C.; Whitehead Kluttz and Lawrence J. Burpee, secretaries.

There were also present: Earle B. Phelps, of the United States Public Health Service, Washington, D. C.; Millard F. Bowen, secretary of the Erie & Ontario Sanitary Canal Co., Buffalo, N. Y.; Frederick H. Newell, Director of the United States Reclamation Service, Washington, D. C.; Brig. Gen. William C. Gorgas, Surgeon General of the United States Army, Washington, D. C.; and Francis N. Stacy, statistician, Lake Superior and Mississippi River Canal Commission, Minneapolis, Minn.

Mr. TAWNEY. Mr. Chairman, on December 1 I received a letter from Mr. George Clinton, of Buffalo, N. Y., in regard to the project of the Erie & Ontario Sanitary Canal Co. in connection with the pollution question at Buffalo, in which letter it was suggested that they would like to be heard, and that the commissioner of public works of Buffalo would also like to be heard, if he could be heard here to-day. I informed them that I did not think there would be any objection to granting a hearing on that subject at this time. I do not know whether the commissioner of public works is coming or not. Do you know, Mr. Bowen?

Mr. BOWEN. I have not been notified. Mr. George Clinton said that he had notified him.

Mr. TAWNEY. Mr. Clinton said he did not know that he would be physically able to be here, but the company would have a representative here. I have had no communication from the commissioner of public works.

The CHAIRMAN. You do not know, then, Mr. Bowen, whether there is any representative here or not?

Mr. BOWEN. No; I have no knowledge on that subject.

Mr. TAWNEY. Mr. Bowen represents the company.

Mr. GLENN. Mr. Bowen came in here to see me a day or two ago, and said he would like very much to have Gen. Gorgas, Gen. Blue, and Mr. Newell heard by us in regard to the feasibility of his canal project. I told him I had no authority to speak, but that I would bring the matter before the gentlemen when they met here and, if we thought it best to have a hearing, we would invite Gen. Gorgas, Gen. Blue, and Mr. Newell to appear before us either to-day or to-morrow to be heard. At the same time, it looks like Buffalo might possibly object to this hearing being had without their having a representative here. I must say that I had never given very much thought to this canal project until Mr. Bowen went over it with me here to-day very thoroughly and told me what he thought it would cost Buffalo to take advantage of it. It looked like a very plausible solution of the whole question, and I could not understand why it was that Buffalo should object to it.

Mr. MAGRATH. How does Mr. Bowen wish to proceed? Would he like Mr. Newell to be heard, or does he want to be heard himself first?

Mr. BOWEN. I wish simply to make this statement, that two years ago last month, at the first meeting in this room upon the subject of the pollution of the boundary waters, one of the experts of the Government, who was then in the Department of Commerce and Labor, Dr. Lucian W. Chaney, testified quite fully in regard to the effect of passing the sewage through the canal that is proposed. Last week it was suggested to me, by a mutual friend, that Mr. Newell, of the Reclamation Service, would be a valuable further witness on the part of the Government to explain to you gentlemen what the effect of the proposed canal would be. I went to Mr. Newell, who kindly consented to investigate the subject, and I referred him to Dr. Chaney, who had previously given testimony on the subject. Mr. Newell has had an interview with Dr. Chaney from his point of view. With that introduction, I would like to have Mr. Newell make such a statement as he has, in the short time since

I saw him, made up for himself upon the subject, and have you ask him any questions that may suggest themselves to you along the same lines as this testimony of Dr. Chaney.

Mr. POWELL. When Gen. Streeter and I were commissioned to take the testimony at Buffalo there was an understanding between us and Mr. Bowen that Mr. Bowen should be at liberty to put before us such further testimony as he could gather. You remember that, Mr. Bowen, do you not?

Mr. BOWEN. Yes, sir.

Mr. POWELL. Mr. Bowen wrote to me on several occasions, and also wrote to Gen. Streeter about having a special meeting. We had gone out there two or three times, and I was perfectly willing to go again, and Gen. Streeter was willing also to go again, but before any action was taken Gen. Streeter was succeeded on the commission and I could not go alone. So I suppose in furtherance of that understanding it would be advisable to hear Mr. Bowen. There is nothing that can come up with respect to which the city of Buffalo could find any fault. The matter is entirely outside of the city of Buffalo. They raised no objection and did not discuss the plan at all when we were in that city. We had a partial hearing at Buffalo on the matter.

Mr. GLENN. Since that time, though, they have taken some action in regard to it.

Mr. POWELL. I know that; but there is nothing to be gained by having a delay and asking representatives from the city of Buffalo to be present. My view would be that it is desirable to hear Mr. Bowen and get the thing through with.

Mr. TAWNEY. Mr. Chairman, I forgot to mention that Mr. George Clinton submitted, as his son agreed to when we were at Buffalo, a printed statement on this subject. I suggested at Ottawa that that printed statement be incorporated in the hearings on the subject of the pollution of boundary waters when the next portion was printed.

Mr. BOWEN. I submitted such a statement and it is in the hands of each one of you gentlemen. On the questions that Mr. Clinton raised in that statement, I think Mr. Newell has made up some opinion, which I would like to have you listen to at this time; and then I have asked permission of the Secretary of War to have Gen. Gorgas present to state, from his point of view, whether such a policy of stopping the pollution as we propose to carry out is advisable from the health point of view and from the point of view of the conservation of health.

Mr. MAGRATH. Whom do you want us to hear here to-day, Mr. Bowen?

Mr. BOWEN. Mr. Newell.

Mr. MAGRATH. And anyone else besides yourself?

Mr. BOWEN. From the point of view of a citizen and a man who has gone into the subject of lake levels, water powers, and conservation generally, there is present here this morning Mr. Francis N. Stacy, and I would like to have him also make a statement. I have also invited another gentleman to be present. He could not be here to-day or to-morrow because he is out of town, but he said he would be back by Wednesday morning and would be glad to tell you his point of view at that time. That gentleman is Dr. Wiley, formerly

of the Department of Agriculture. Those are all the witnesses that I desire to be heard. Furthermore, in the statement that was filed with you at the meeting two years ago, or following that meeting, the point of view of George Shiras was given in a brief statement, and in order that you gentlemen might hear Mr. Shiras personally he has said that he would be very glad to appear before you just for a few moments to elucidate just what he has written in his statement on this subject which is filed.

Mr. MAGRATH. It appears to me, Mr. Bowen, that you should have those gentlemen here if you want them heard.

Mr. BOWEN. Gen. Gorgas had an engagement this morning with the Secretary of War, and Dr. Wiley could not be present until Wednesday morning, but Mr. Shiras will be in at any moment, I think. Mr. Newell and Mr. Stacy are here.

The CHAIRMAN. Without any further waste of time, I think, Mr. Newell, we would be glad to hear now any statement that you may care to make.

STATEMENT OF MR. FREDERICK H. NEWELL, DIRECTOR OF THE UNITED STATES RECLAMATION SERVICE.

Mr. NEWELL. Mr. Chairman and gentlemen, in appearing before you it is not as an advocate of any particular scheme, but as an employee of the Government who has devoted 26 years' consecutive study to water problems, many of them prominently connected with irrigation, power, and other industrial uses of water. Mr. Bowen has asked me to appear before you in an advisory capacity as representing the general public interest, and to answer such questions as I may be competent to answer.

I have not studied this proposed scheme on the ground, but have gone over the maps and drawings and the printed description, and have been impressed with the importance of the disposal of the sewage of Buffalo, and, incidentally, with other industrial uses of the water, which are very important. It struck me in this way, to put it in the simplest form: There is a certain amount of sewage waste which must come out of the city of Buffalo. It may go either out of the front door into the Niagara River and be a source of pollution turned into the water works of other cities, or out of the back door into a conduit in which it can be controlled to that extent. The amount of water which is going down the Niagara River and from Lake Erie into Lake Ontario is practically fixed by physical conditions until such time as an obstruction, such as a regulator, is placed in the river to hold the water levels and to maintain artificially, as I believe will be done some time, the levels in the lake and the amount of water which is delivered from Lake Erie to Lake Ontario. Pending the fixing of that artificial regulator, the diversions from either side will, of course, to that extent take from the water which flows over Niagara Falls, but the net amount, as I see it, delivered from Lake Erie to Lake Ontario would be practically the same, depending again very largely on climatic conditions.

The project is to remove the waste and sewage from the city of Buffalo and the adjoining inhabited places through a back way, which at the same time not only conducts the sewage and dilutes it,

but also takes care, to a certain degree, of the streams which are flowing toward Buffalo and the adjoining towns and which are more or less destructive in storm floods to the industries in that locality. From the study which I have been able to give the matter from the hydrographic side it would seem to be a very happy solution to reverse the current of the streams which are now flowing into the Niagara River and into Lake Erie and to use that current to deliver the sewage, as I have said, through the back door into Lake Ontario at a point relatively remote from inhabited towns and at a point where it can be greatly diluted with the waters of Lake Ontario. That is on the assumption that there is a certain amount of material that has got to be disposed of somehow, and the quicker we get it together in one channel the better it is for the general public health of that whole community, because diffused as it now is through an infinite number of smaller drains and sewers discharging into the river at the influence of winds it does to a certain extent enter the waterworks and interferes with the industrial purposes on that stream.

That, briefly, is the only point that I can present to you, unless you gentlemen care to ask some further questions.

The CHAIRMAN. Have you made any calculation as to the amount of water that would be necessary for the successful operation of that drainage when completed?

Mr. NEWELL. To operate as a drain itself a perhaps relatively small amount of water would be necessary, but for the dilution of the sewage and for the incidental usage of power 5,000 or 6,000 second-feet would be desirable. The more dilution you give it the better it can be handled for the purposes involved. Of course I understand that this is not a purely municipal or philanthropic operation. There must be enough water power developed to make the thing a feasible enterprise, or otherwise it would not be undertaken along these lines. As a sewer alone it would hardly pay.

Mr. TAWNEY. Mr. Newell, what is your judgment as to the distance that is necessary to effect proper dilution of the sewage so as not to impose unreasonable burdens upon water-purification plants farther down the river?

Mr. NEWELL. That is an open question. We know that under certain conditions the bacteriologic contents may live for days or weeks or months, so that mere distance alone will never answer the question.

Mr. TAWNEY. What other facilities for dilution is contemplated in this scheme?

Mr. NEWELL. There is none except to get it in a single channel, diluted to the largest practicable extent, and then deliver it into the lake where the action of wind and waves in the lake will in turn destroy the bacteria. It now goes into the lake, but through diffused channels rather than through one channel.

Mr. BOWEN. Right there, it has been our offer always that if it becomes necessary in the future to render the water innocuous and harmless before it enters Lake Ontario we promise to take such means of purification, other than the dilution and sedimentation, as may become necessary in the judgment of Government officials to make it innocuous and harmless before emptying it into Lake Ontario.

Mr. GLENN. Mr. Newell, by taking out sufficient water to operate

that canal successfully, what effect would that have upon the scenic conditions at Niagara Falls? Would it be perceptible?

Mr. NEWELL. I doubt if the human eye could detect a difference. We will say that the flow is at least 200,000 cubic feet per second. It would be impossible for the eye to detect a diversion of even 10 per cent of that. Twenty thousand cubic feet I do not think could be seen by the eye.

The CHAIRMAN. Laying aside the commercial phase of the question, as an expert, if you were going to undertake to remove the water pollution from the Niagara River, what would be your probable plan?

Mr. NEWELL. The first plan would be to attack the worst of the pollution; that is to say, segregate certain manufacturing establishments and certain sewers and treat those separately, and then gather the relatively noxious material, the highly polluted material, into a channel and discharge it as quickly as possible out of the way of buildings into the large lake. That is to say, under our present state of development it would hardly be practicable in a scattered community like this to treat all the sewage. We would have to treat it in detail, taking the worst first, and then as the quantity developed and our knowledge of sewage developed gradually treat the less and less offensive.

Mr. POWELL. You are speaking of the water that is more or less offensive. Do you mean by that the different communities, or are you speaking of sewers that serve the purpose of a single community?

Mr. NEWELL. I had reference in general to certain communities or sewers some of which receive a large amount of manufacturing waste and which are particularly obnoxious. Other suburban communities, for example, have a sewer system which receives a good deal of waste water, and the effluent is relatively harmless and might flow into a body of water of this size indefinitely. Comparisons have been made with the city of Chicago, where they built their large sanitary canal; and I think the testimony has shown that since the canal has been built, although the sewage of Chicago is literally dumped into the river on the city of St. Louis, yet the water of St. Louis is better than it was before the sewage of Chicago was put there. So much fresh water has come in with the sewage that on the whole the aggregate is better than it was before. That may be disputed, but it seems to be the general assumption.

Mr. GLENN. Mr. Newell, in the matter of treating the sewage by canal, such as you are speaking of now, in your judgment can the plan of taking that sewage and emptying it into Lake Ontario be operated more successfully than by requiring the city to treat its sewage by sedimentation, fine screening, and chemical application before emptying it into the Niagara River?

Mr. NEWELL. From a theoretical standpoint, if we could require the city to treat all its sewage and the adjoining towns and manufacturers to do likewise, that would be the ideal we would aim at, namely, to never pollute any water by putting manufacturing waste or human waste into it; but we have not yet reached the condition of many European countries where population is dense enough and funds are available for that ideal treatment, and this is the practical alternative. If it were possible to force the city of Buffalo and all

those communities never to discharge any sewage into the stream, I would say let us do it.

Mr. POWELL. That is the ideal way?

Mr. NEWELL. That is the ideal way; but we have to consider the practical situation. What can we do under the existing situation?

Mr. GLENN. Now, this being practicable, and also being cheaper for the city of Buffalo, do you know any reason why the city should prefer not to put in that canal? Is there any possible reason for preferring one to the other?

Mr. NEWELL. I have not heard any argument on the other side.

Mr. GLENN. As a matter of fact, we find some of them are opposed to this plan and want to treat the sewage in the other way; yet, according to the statements made here, this plan would cost comparatively little.

Mr. MAGRATH. Are you indorsing Mr. Bowen's plan, Mr. Newell, on the supposition of a dam being placed in the Niagara River, or do you say that if there is no dam in the Niagara River that still it is a sound policy to pursue?

Mr. NEWELL. My present opinion is that it is a sound policy to pursue, whether or not the dam is built. I am also fully convinced that some of us will live to see such a dam built there, because of the obvious necessities of the two countries.

Mr. MAGRATH. What effect would 6,000 second-feet additional taken out of Lake Erie have upon the levels of Buffalo Harbor?

Mr. NEWELL. That is an exceedingly difficult question to answer. At first glance it might be said that it would have an inappreciable effect, for the reason that it does not increase the amount of water that is delivered from one lake to the other; it is simply sent around another way. That is to say, what goes through the canal would go over Niagara Falls.

Mr. MAGRATH. Do you contend that even with another channel carrying 6,000 second-feet the discharge from Lake Erie would not be increased?

Mr. NEWELL. I doubt whether it would be materially increased.

The CHAIRMAN. This canal would have to be low enough to reverse the current of the streams flowing into Buffalo now, would it not?

Mr. NEWELL. The canal must be of a sufficient grade and depth to take that definite amount of water, and the resistance to flow through the canal, of course, would govern the amount which is let in there, as compared to the distance of flow down the Niagara River. Now, it does not seem to me, from the hasty analysis I have been able to make, that the effect of that on lake levels would be appreciable. Theoretically there would be some effect, but there are so many other controlling factors that I question whether we would be able to detect the influence on that particular channel.

Mr. MAGRATH. The Waterways Commission, in dealing with lake levels, has undertaken to say that the discharge of 10,000 second-feet by Chicago out into the Mississippi Valley is affecting the levels of those lakes by several inches.

Mr. NEWELL. I am aware of that work and of the conclusions. I think, however, there is a decided difference between the two. The Chicago Drainage Canal is abstracting a definite amount of water

from the entire system, and to that extent definitely affecting it. We are providing in this scheme another means of communication paralleling an existing river, and I have yet to appreciate the arguments that would show that by providing that other system we would do other than draw from the natural channel.

Mr. MAGRATH. What would be the difference between building a canal from Lake Erie and dumping the water into Lake Ontario and building that same canal, or at least a canal of that same capacity, from Lake Erie and dumping it into the Ohio?

Mr. NEWELL. I might put it in another way: The drainage of the Lakes is down through Erie into Ontario, and the short-circuiting of that drainage through this canal would, so far as my investigation shows—I have not gone into this matter thoroughly—take from the water of the Niagara River rather than lower the level of the lake, because the outflow of the Niagara River is dependent directly upon the variation in lake levels. Unless we assume that the opening of this canal is such as to take from the river—I have not yet any data to prove it either way—we have got to assume that the same amount of water will go in the combined channels under a given head that would go into a single channel. But I want to state very frankly that I have not given this matter consideration, more than to be able to give you a general impression.

Mr. POWELL. In other words, you say that it is the section of the discharge presented by the river farther up than the point where this tapping would take place that controls the discharge?

Mr. NEWELL. Very largely; yes. My thought would be that if we should imagine a wall put down the Niagara River which would carry 6,000 second-feet we would have the same amount of water going down. Instead of that you simply transfer it around.

Mr. POWELL. It would strike me that you are enlarging the sections.

Mr. NEWELL. Yes; that is true; you are.

Mr. POWELL. That would give a larger discharge, would it not, unless it is the section above that controls the flow from the Lakes?

Mr. NEWELL. Yes.

Mr. MAGRATH. The canal leaves Lake Erie at a considerable distance above the Niagara River.

Mr. POWELL. Then it must certainly increase the discharge. As long as you keep the water of Lake Erie at a given height the flow through Niagara River is going to be exactly the same. If you are going to have another mode of exit, you are going to have an additional section of discharge.

Mr. NEWELL. I have made my general statement, gentlemen, and answered such questions as I could. If there are any other questions you desire to ask, I shall be glad to answer them.

Mr. POWELL. Has this matter been up before the Corps of Army Engineers? There was some evidence before us that it had been.

Mr. NEWELL. I do not know.

Mr. POWELL. You are not familiar with the reports that they made upon it?

Mr. NEWELL. No.

Mr. POWELL. Has this feature of the thing ever struck you: It is not an engineering feature so much as it is a feature of proprietor-

ship? The United States territory at Niagara Falls can fairly lay claim to the power at Niagara Falls. Would not there be some kicking on their part if this water were diverted, and that which was at their doors and would be the means of increasing industrial development were going to be withdrawn and taken around to increase the importance of Lockport and create industries there?

Mr. NEWELL. Certainly there would be more or less of that.

Mr. POWELL. I should think there would be a large amount of friction.

Mr. NEWELL. I understand the object of your commission is to adjust those ideas between the two countries.

Mr. POWELL. But I am looking at it not from an international but from an intrastate point of view.

Mr. NEWELL. Naturally that feeling arises everywhere where a large development takes place.

Mr. MIGNAULT. How would it affect the users of power on the Niagara River?

Mr. NEWELL. The largest effect would be caused by cutting into such market as they might have. The indirect effect would be the assumption that possibly they would get a little less head of water on their wheels, but that would be insignificant. I presume that no power company looks with equanimity on another large development near by.

Mr. BOWEN. Mr. Newell, the ratio of 6,000 to 220,000 would be less than 3 per cent, would it not?

Mr. NEWELL. Something like that; yes. It is for that reason that I have said that I thought the effect on lake levels would be inappreciable. An enlargement of the channel would tend that way, but there are so many other forces at work that the appreciable amount, I think, would be very small.

Mr. TAWNEY. Could this diversion be effected, Mr. Newell, without legislation on the part of the States and the Government of the United States?

Mr. NEWELL. I assume that it would be necessary to get some legislation from New York, if it is not already involved in the charter of the company.

Mr. TAWNEY. It would be necessary to get legislation from the Government of the United States as well, would it not? Anything affecting the navigable waters have to have the authority of the United States Government as well as the authority of the State.

Mr. NEWELL. Yes; I presume so.

Mr. GLENN. Would not the Canadian Government have a right to object, if they saw fit?

Mr. TAWNEY. Only before this commission.

Mr. POWELL. The United States has a right to take up to a certain quantity. They have not taken that quantity yet, and the amount involved in this proposed scheme would not exceed the quantity.

Mr. BOWEN. May I call your attention, Mr. Tawney, to the opinion of the Attorney General, a copy of which opinion I gave to you and, I think, to the other members of the commission, in regard to there being no necessity for further action by Congress, because the President and the departments, as the Attorney General has written in his opinion, have power under this treaty to carry out the terms of the treaty without further action by Congress. As for the State of New

York, the charter of our company is sufficient except as to the rights that we will get from the canal board of the State of New York for the use of the branch of the old Erie Canal from Black Rock to Tonawanda, which is to be abandoned as soon as the barge canal is finished and the boats from the barge canal enter the Niagara River instead of the old Erie Canal from Tonawanda to Black Rock.

The CHAIRMAN. Mr. Stacy, we are ready to hear from you now on this proposition.

**STATEMENT OF MR. FRANCIS N. STACY, OF MINNEAPOLIS, MINN.,
STATISTICIAN, LAKE SUPERIOR AND MISSISSIPPI RIVER
CANAL COMMISSION.**

Mr. STACY. Mr. Chairman and gentlemen, I appear here in the capacity of a private citizen. I became interested in the subject, however, through appearing in Washington in behalf of my State, Minnesota. My home is in Minneapolis and for a year past I have been a statistician for the Lake Superior and Mississippi River Canal Commission, which was created by the last Mississippi Legislature; and, incidentally, I have also been a delegate to the National Rivers and Harbors Congress, and in connection with the commission I appeared before the rivers and harbors board.

At first glance at this proposition I was somewhat disturbed because of the possible effect it might have on lake navigation and commerce, in which the State of Minnesota is deeply interested. As shown by the report of the Chief of Engineers, which the secretary handed me a few moments ago, the value of the Great Lakes commerce passing through the canals at St. Mary aggregated last year \$865,000,000. The tonnage was approximately 80,000,000 and the cost per ton-mile was only sixty-eight hundredths of 1 mill, which is less than 10 per cent of the average rail cost.

Of course, Minnesota supplies or receives very nearly 70 per cent, doubtless fully 70 per cent, of the total tonnage passing through the St. Mary Canal, and the Lake Superior region and the States tributary thereto would naturally be anxious about any diversion that would materially damage that commerce. In looking at the subject one point becomes immediately apparent, and that is that the level of Lake Erie, which might be affected an inch or more, would not affect at all the level of the upper lake or of the St. Mary Canal or the Detroit River. Of course, the upper lake, Lake Superior, for example, with relation to the lower lakes is the upper mill pond of which the Detroit River is the tail race and of which Lake Erie is the pool at the bottom of the tail race. The level of the pool at the bottom of the tail race would not affect either the depth of the tail race or the Detroit River and its connecting St. Mary Canal, nor would it affect at all the elevation or the levels of Lakes Superior, Huron, and Michigan. So that eliminates that phase of the question.

Mr. MAGRATH. Do you think that theory is sound, Mr. Stacy?

Mr. STACY. Yes, sir. There then remains the question of the effect upon the lake commerce, that is whether slight diversion would affect the depth in the harbors on Lake Erie. I happened to pick up this map in the room here—

Mr. MAGRATH. Probably you misunderstood me. As I gather from you, you claim that the lowering of Lake Erie has no effect upon the levels above?

Mr. STACY. No; nor upon the depths of St. Mary Canal.

Mr. MAGRATH. I am afraid that I can not agree with you in that view.

Mr. STACY. Now, in regard to the effect of the diversion; I happened to pick up here the message of former President Taft, accompanied by the scientific papers of the War and other departments, and I notice an estimate by Maj. Charles Keller, of the Corps of Engineers, United States Army, which reads as follows:

In inches, the diversion of 19,350 cubic feet per second in the Chippawa-Grass Island pool reducing the depth at the head of the river seven-eighths inch.

The estimate in regard to the effect of the diversion of 6,000 feet per second upon the level of Lake Erie very largely runs all the way from a fraction of an inch to the highest point, which, I believe, is 3 inches. Now, the company proposing the Erie and Ontario Sanitary Canal project agrees as a condition of their grant to maintain the lake level.

Mr. BOWEN. Putting in such engineering works at their own expense as would compensate for the 6,000 cubic feet per second.

Mr. STACY. After looking into the matter carefully I have ceased to have any anxiety in regard to the effect of this diversion of 6,000 cubic feet upon the commerce of Lake Superior. I think it is comparatively trifling, and there are a number of offsets that would be of benefit to commerce. In the first place, the Great Lakes commerce will be largely benefited by canals—the New Welland and the New Erie Barge Canal—the Welland handling the commerce that passes through the Canadian ports and the Erie Barge Canal that which passes through the American ports. The one drawback in regard to the upper terminal of the Erie Barge Canal is its location down on the shore of Niagara River toward Tonawanda, so that lake barges westbound will have to climb the river and go against a swift current. In the case of light cargoes that might not be serious; in the case of heavy cargoes it might be serious. This company by the terms of this charter provides a terminal south of Buffalo at the mouth of Smokes Creek, at the town of Lackawanna, as a feeder to the Erie Barge Canal, and that would be a distinct benefit to lake commerce. Then, the development of additional power through this 6,000 cubic feet would develop industries, all of which are near Lake Erie and have the low-water rate westward to all harbors on the Great Lakes. The importance of the nearness of the location is shown in this, that while the average freight cost per ton of the total 80,000,000 tons handled through the Soo Canals last year was only 56 cents per ton for an average haul of 820 miles, 56 cents would be equivalent to a rate per ton on an average rail haul of about 75 miles. So that whatever manufactures are developed, whatever products are produced as a result of the additional use of power at Buffalo and nearby points, is of great interest to the harbors of the upper Lakes and to all of the people tributary to the Great Lakes by reason of their being able to get the manufactured products at a low transportation rate. At 56 cents a ton for a haul of 820 miles, or from Buffalo through, it would be very nearly 1,000 miles instead of a rail rate that would be many times that figure.

The third offset would be on the removal of pollution from the east end of Lake Erie and the Niagara River which generates typhoid

germs, and which is a distinct menace to life and to commerce through the whole of the Great Lakes region, and, for that matter, for the whole country, because the tourist visitation at the falls is large and the typhoid germs are distributed generally. So there are three points of advantage which I think are a complete offset to the slight disadvantage.

There are one or two other features that I would like to refer to just briefly. One is with regard to sanitation. It seems to me that your commission has had an abundance of expert testimony from Dr. McLaughlin and others, and I have no doubt that you are thoroughly convinced that the heavy losses by death from typhoid fever from Niagara Falls to Buffalo and all points on the Niagara frontier is a national and international menace that must cease.

In regard to the disposal of the sewage of these towns for a present population of something like 750,000, which is increasing at a comparatively rapid rate, the question is simply this: Shall the sewage of this large population be dumped into their drinking water and into the water that is used for navigation and commerce, or shall it pass through the back door, as Mr. Newell says, through a sewer? Shall it be dumped into the intake or into a sewer? This company is prepared to provide a sewer. The engineering estimates in regard to the cost of the disposal through drainage canals are from \$25,000,000 to \$30,000,000. That would be the cost to Buffalo, the Tonawandas, Niagara Falls, and the Canadian towns for the disposal of this waste through their own drainage canals. The estimate, on the other hand, for the cost of connection of the sewers of these towns with the Erie & Ontario Sanitary Canal are from \$1,000,000 to \$2,000,000. The gains will be to all the municipalities that are now suffering from this sewage. More than that, all the population on the Canadian side will be relieved of this vast tonnage of American germs, and I imagine they would be very glad to get relief from that source.

Now, just one point in regard to the power. The fact that appeals to me chiefly in regard to this power proposition as compared with other propositions now installed is this: On the route proposed, the 38-mile route from Lake Erie and Lackawanna down to Lake Ontario, the canal will pass through a geologic formation that is graphically described in the atlas of the Geological Survey, which shows that the route proposed is an old route used by the Niagara River and Lake Erie during the glacial epoch. The old glacial gorges still exist alongside the route, and along Lockport the Geological Survey's atlas shows the gulf, which is a deep gorge 2 miles long and with an average depth of about 100 feet. That was occupied, the Geological Survey experts tell us, by the Niagara during the last glacial epoch. This gorge has a capacity, it appears, that is equivalent to a 15-hour flood of the Buffalo River at 25,000 second-feet per minute. The Buffalo River, I understand, at times has a flood as great as 20,000 second-feet. The gulf gorge down there above Lockport will take care of that flood for the maximum limit of the flood. These floods, it appears, run for 15 hours. Then there are other gorges in the same neighborhood within reach of the canal by feeders that can also be used for storage. Therefore this proposition can take care of the flood periods of the half dozen streams

that are tapped by the canal, such as Smokes Creek, Buffalo River, and the rest of them.

There is another point of view along that same line in regard to storage. The level of Lake Erie appears to be, on the average, during the months of March, April, May, June, and July, 18 inches to 2 feet higher than during the months of October, November, December, and January. It varies, but I know that in some years the difference is fully 2 feet and nearly always as much as 1 foot. Possibly 18 inches might be a fair average of the difference in lake levels between the spring months and the winter months. Now, a route that has storage capacity—settling basins that can be used for filtering the water—has an advantage over the main-stream routes on which storage is not practicable. It has seemed to me that there is a vast advantage for this inland route, in that it can provide a series of storage reservoirs at a comparatively low cost of excavation, because nature has already excavated them in the main and it can take care of the high-water levels in the spring and store for the low-water season quite a large proportion of its requirements during that season. In a comparison of projects it seems to me that the project in question has that distinct point of advantage.

What I have thus said in a rambling way this morning, if the commission desires, I shall try to shape up in the form of a paper with exhibits of the principal data, so that it will be in intelligible shape for you gentlemen to consider.

Mr. TAWNEY. Mr. Stacy, before we consider the matter of putting into the record exhibits along the line of your talk, I want to ask you if you have given any thought to this phase of the question: The two Governments have referred to this commission two questions, one with regard to the fact of pollution and the other with regard to the remedy where it is found to exist in violation of the provisions of this treaty. It is manifest, to my mind at least, that any project—any definite, specific project—which the commission might recommend as a remedy for the pollution which exists in contravention of this treaty that would have the active opposition of the municipalities on either side of the line could never be carried out and would not be carried out by the Governments. Now, is it not necessary for the friends of this proposition, as I have endeavored time and again to impress upon Mr. Bowen, to go to these municipalities first and see if it would not be a great benefit to them and to demonstrate to them the practicability of the scheme and get their indorsement? Then, if the commission recommended it, it would be recommending something that had the support of the communities that are directly involved financially as well as something that benefited public health. It would seem to be futile for the commission to waste any time in recommending that which could not be carried out. We have no power to make a final decision. Our power is simply to make recommendations, and whatever we recommend to the Government must be not only practicable but reasonably in accord with the public sentiment of the communities affected.

Mr. STACY. There is a great deal of force in your point. I can appreciate, however, the difficulty that the company might have in getting a public official who is elected by taxpayers to favor in advance any kind of a project that might increase the taxes by reason of the effect it might have upon his reelection, but I think

it would be desirable at least to have meetings at these places to ascertain the public sentiment. I think that would be a very good way to proceed. I can see that an engineer—a city engineer, for example—in Buffalo or Tonawanda or Niagara Falls might hesitate to O. K. any project in advance of the action of the city council, fearing that some opposing candidate for his job might say, "Here is a man who wants to plunge us into debt for the benefit of a project."

Mr. GLENN. You say that if the water were treated by the different cities along the river it would cost \$20,000,000 or \$30,000,000, but if treated by this canal project it would cost only \$1,000,000 or \$2,000,000. That would be a decrease in taxation instead of an increase in taxation.

Mr. STACY. That is true; but the point is that you gentlemen have not yet brought sufficient pressure to bear to force upon them the idea that they have got to dispose of that sewage, and when that is done, when it comes to a choice between \$20,000,000 or \$30,000,000 and \$1,000,000 or \$2,000,000, they will of course take the latter.

Mr. GLENN. I rather think you are mistaken about that. I think since we had our last meeting out there they have come to the conclusion that something has got to be done.

Mr. STACY. From what I have seen of the sentiment of those towns, I would say that they are favorable; but I am not a resident there. All I have seen is in printed articles and the testimony of witnesses; but my impression is that the sentiment is decidedly favorable.

Mr. BOWEN. May I interrupt just here? There is in evidence before the commission a petition signed by the health officials of Lackawanna, Buffalo, both the Tonawandas, and Lockport and Niagara Falls, together with several other health officers of the towns, to this effect:

Now, in view of the fact that the bill as drawn conveys all surplus waters from above the falls of the Niagara River, which the United States may, under its treaty powers, bestow to existing water-power monopolies, thereby doing a great wrong and damage to the city of Buffalo and to the American Niagara frontier, we, the undersigned petitioners, residents of the city of Buffalo and of the said Niagara frontier, respectfully protest against the manifest purpose of the bill, as revealed in its wording, and do urgently petition the Congress to so change the spirit and wording of the act as to authorize the Secretary of War to give the unappropriated waters covered by the act to that company or corporation which can and will develop the largest amount of power from the volume of water which the Secretary of War is empowered to give away, and which will give to the public the greatest compensation for the use of such waters, and which will further contribute most to the sanitation and well-being of the city of Buffalo and the inhabitants of the Niagara frontier in the State of New York.

The portion of the petition which I have just read appears in H. R. 26688, Sixty-first Congress, second session, relating to the control and regulation of the waters of Niagara River and the preservation of Niagara Falls. That petition was put in evidence before this commission at the hearing in Buffalo last June. It was signed in 1912. The original petition is in the files of this commission.

Mr. GLENN. These people must have some object in opposing this scheme or they would not do it.

Mr. BOWEN. May I explain that? The explanation is simply this: As far as the Tonawandas are concerned, there are strong business men there who are interested in making Tonawanda the actual terminal of the barge-canal system, and who desire to compel lake vessels to go there and do their transferring. On account of that commercial reason, although the people of Tonawanda at meetings which I have addressed have favored this project, the official action of the board of trade has never been given in favor of it. It is simply a commercial reason, and, furthermore, I understand from a question that was put to me by one of the commissioners recently there has been some statement made to you that the level of this canal would not be low enough to take the sewage of the Tonawandas. I respectfully submit that the level of the canal as shown by the profiles is so far below the deepest of the sewers of the Tonawandas that there is no question about this canal being able to drain backward into it all of the sewage of the Tonawandas. The State of New York has planned and is carrying out a plan to reverse the flow of Tonawanda Creek, or what is now the Barge Canal, so that instead of emptying as it has always emptied the flow will go toward Rochester, and the entry point of the Barge Canal at Tonawanda will draw from Niagara River the water and consequently all the sewage of the Tonawandas and the towns below there through the Barge Canal. Of course, that is not an international question, but still it ought to be taken into consideration in deciding this whole problem. As far as Buffalo is concerned, I can safely say that the citizens of Buffalo have to me in meetings in every ward of the city expressed their approval and wish for this scheme, but the board of public works, actuated by whatever motives it may have had, has never accepted it except by signing this petition. The petition contains the signature of the commissioner of public works as well as that of the mayor of Buffalo. They have not taken any further action. I think it will be found, if you go more deeply into the subject, that the people of the whole Niagara frontier favor this almost without exception, except as they have selfish interest, as I have stated.

Mr. STACY. Just one word on that point. Of course, there is a very distinct amount of opposition from the American Niagara Falls Power Co. and the Niagara Falls Hydraulic & Power Manufacturing Co., both of which have applied to the Government for 400,400 cubic feet under the treaty for power purposes. Large industrial companies of that kind which are doing a great work up there in developing business naturally are influential.

Mr. TAWNEY. Why should they oppose this scheme?

Mr. STACY. Because they would like to use the 400,400 feet themselves, and they have applied for it.

Mr. TAWNEY. But they can not. They are getting now all they are entitled to.

Mr. STACY. Then, they have a gentleman's agreement in regard to rates, apparently, and are not anxious for competition. Of course, that would account for a certain amount of opposition.

Mr. GLENN. I can understand the matter with respect to Buffalo, but I can not understand why Niagara Falls and the Tonawandas prefer the expensive way to the cheap way.

Mr. STACY. It might be a good plan for the commission or for the friends of this project to make a canvass there, to call public meetings, and ascertain what the public sentiment is.

Mr. TAWNEY. To my certain knowledge the commission has for two years tried to find out the attitude of Buffalo toward this scheme, and it has not yet succeeded in doing so.

Mr. STACY. I suppose business people in a certain locality are slow to incur opposition.

Mr. TAWNEY. I am speaking of the officials of the city of Buffalo and not the citizens of that city.

The CHAIRMAN. I do not care anything about the commercial side of this question. What I am trying to get is information that will enable me to reach a final conclusion before making a report in regard to this water pollution. I do not know but what my colleagues are well established in working it out. I would like to hear all the testimony I can that would enable me to reach a final decision.

Mr. STACY. I would just call attention to one table here. The death rate from typhoid fever for the big city of New York is 17 per 100,000 for a period of 10 years. That of Buffalo is 27 per 100,000.

Mr. POWELL. We have all that information, Mr. Stacy.

Mr. STACY. For the Tonawandas the death rate was about 30, and for Lockport 50. You are also familiar with the method of disposal by drainage at Chicago. For 10 years prior to the Chicago Drainage Canal the average death rate from typhoid was 56 per 100,000. During the 7 years following the death rate was 17, I believe. So that the benefit of the disposal of sewage by that method as compared with others is shown by that object lesson.

Mr. GLENN. As Mr. Tawney said a few moments ago, we can only make recommendations; we can not make any final decree. Of course we want to, and are going to, recommend what is best, but we do not want to recommend something to the two governments that can not be carried out. Therefore I would like to know why it is that Tonawanda and all the other cities, including Buffalo, with a canal that will cost them about one-twentieth part of what it will cost them to treat their sewage, should fight any bill in Parliament or Congress to destroy any recommendation that we might make.

Mr. STACY. Do you anticipate that the opposition will be greater than the friendship for the project?

Mr. GLENN. I would take it for granted that these officials of Buffalo would not be fighting this thing if they thought the scheme was one that would be of benefit to them.

Mr. STACY. I have received the impression that they were favorable, but they were not in a position to express an official opinion.

Mr. GLENN. Do you think if we should tell the people of Buffalo that we have thoroughly investigated this matter and made up our minds to compel them to treat their sewage, so that they could no longer hesitate on that ground, and that we would like to know their views and their ability to treat it in the best and cheapest way, they would be likely to come out in favor of it?

Mr. STACY. I think you would very likely hear from them and get a more accurate index of public sentiment.

Mr. BOWEN. A year from January it would be unanimous, because then we shall have the commission form of government in operation.

Mr. MAGRATH. If I do not vote for this, Mr. Bowen, you can understand that I am opposed to it, and my opposition is not on account of any objection that the people of Buffalo might have to it.

Mr. TAWNEY. How long has this project been before Congress?

Mr. BOWEN. I have never introduced any bill in Congress in regard to it.

Mr. TAWNEY. Have you had hearings before the Committee on Foreign Affairs during the last two Congresses?

Mr. BOWEN. Yes; on the general bills that they have introduced to regulate Niagara River and a bill, called the Alexander bill, which was introduced before that time and referred to the Committee on Rivers and Harbors. There has never been an attempt on our part to introduce any bill, but only to see that a bill introduced by others would be fair.

Mr. TAWNEY. No committee of either House has ever passed favorably upon any bill in connection with the matter, has it?

Mr. BOWEN. Neither favorably nor unfavorably.

Mr. TAWNEY. I recall that two years ago this winter you were having hearings before the Committee on Foreign Affairs for several months on this same project.

Mr. BOWEN. Those hearings resulted in a bill called the Kline bill being reported out of committee last August. It has never been brought up in the House. That Kline bill provides that any amount the Secretary of War may decide upon may be used for sanitation and navigation.

Mr. TAWNEY. Yes; but it does not pass affirmatively upon your project.

Mr. BOWEN. They never have passed upon it either affirmatively or negatively. We have not yet heard from Gen. Gorgas. If you are going to be in session Wednesday morning, Dr. Wiley will be at liberty at that time to appear before you, and I would request that this part of the hearing be postponed until Wednesday morning.

Mr. MAGRATH. Mr. Bowen, we went to Buffalo and held hearings and gave you the fullest opportunity to get your evidence before us at that time. To ask us now to stay here until Wednesday when possibly we may get through this afternoon I think is unfair.

Mr. BOWEN. I thought you were going to be in session several days.

Mr. TAWNEY. Gen. Gorgas and Dr. Wiley have never given this project any detailed study, have they?

Mr. BOWEN. Only from data.

Mr. TAWNEY. They would speak of it merely from a general sanitary standpoint?

Mr. BOWEN. That is all.

The CHAIRMAN. I have arranged for Gen. Gorgas to be heard this afternoon at half past 3.

Mr. BOWEN. I would like to put in evidence these blue prints that I have here and also a certified copy of the articles of incorporation of the Erie & Ontario Sanitary Canal Co.

(The commission thereupon took a recess until 3.30 o'clock p. m.)

AFTER RECESS.

The commission met at the expiration of the recess, all the members being present as aforesaid.

Mr. BOWEN. Mr. Chairman, may I present two or three additional matters? In connection with the brief statement of Mr. George Clinton, I would say that after it was submitted to each of you by mail Mr. Tawney wrote to Mr. Clinton and this letter of Mr. Clinton's in answer to Mr. Tawney's suggestions I think is pertinent, and I would like to have it put in the record.

Mr. TAWNEY. I do not think it should go in the record unless my letter goes in, because I disclaim entirely committing the commission to any policy. I was giving only my own views.

Mr. BOWEN. The letter to Mr. Clinton from Mr. Tawney and Mr. Clinton's communication in reply are as follows:

NOVEMBER 26, 1914.

HON. GEORGE CLINTON,
1012 Prudential Building, Buffalo, N. Y.

DEAR SIR: I am in receipt of your letter of the 25th instant, and also in receipt of the printed copies of your statement on behalf of the Erie & Ontario Sanitary Canal Co., submitted in connection with the remedy for the pollution of the waters of the Niagara River by the discharge of raw sewage of the city of Buffalo; also the statement of Mr. Thebaud.

If you have not already done so, please send to the secretaries of the commission at Washington and Ottawa about 1 dozen copies each, so that the statement may be printed in the final report of the testimony taken at Buffalo, and also that each member of the commission may have a copy for his own use.

In this connection permit me to say, as you know the conclusions and recommendations of the commission in this matter will not be final, whatever recommendation the commission concludes to make in the premises will have to be adopted by both Governments before they can become effective. Whether or not the two Governments will do this will depend very largely upon the favor with which these recommendations are received by the two principal offending municipalities—Buffalo and Detroit—otherwise their protest to our Government against the adoption and carrying out of our recommendations as remedies would in all probability necessitate a resubmission of this question for further consideration. This would be unfortunate, as both Governments will have expended a large sum of money in the investigation and if recommendations are made which can not be carried out because of opposition, the commission would then have failed in the accomplishments of one of the main purposes of its creation. For these reasons I think the commission will desire in the consideration of the second branch of the reference to reach conclusions upon which to base its recommendations as to remedies that are not only effective but also conclusions and recommendations that will reasonably meet with the approval of these municipalities. In my judgment it would be folly for the commission to make recommendations which we know in advance would meet with the opposition of more than 1,000,000 people on our side.

The commission has reached no conclusion whatever on the subject of remedies for the pollution of the Niagara River, nor has it discussed that phase of the question I have mentioned. What I have said concerning the necessity of our recommendation being reasonably in accord with the favor of Buffalo and Detroit is the expression only of my own views on the subject. I have given you these views for the purpose of pointing out to you the advisability of your submitting to the city of Buffalo the proposition of the Erie & Ontario Sanitary Canal Co. as a remedy for its pollution for these waters.

I am informed that the engineers of the War Department have reported adversely on your proposition; if, therefore, the commission should conclude to recommend your proposition as a remedy and it was opposed by the city, the recommendation would fail and would not be carried out; if on the other hand your proposition met with the approval of the city, the questions then for the commission to consider would be altogether different. The commission will meet at Washington on December 14 at its offices in the Southern Building

for the further consideration of questions in connection with this branch of the reference. If you desire to be heard at that time an opportunity for that purpose will be given you.

I trust you will not consider this as prejudgment on my part of the practicability of your proposed remedy but rather an expression of my individual opinion with respect to the plan under which you could proceed to ascertain the attitude of the city of Buffalo toward your proposition and the necessity for so doing.

Should you conclude to appear before the commission on December 14 will you kindly advise me and also notify the commissioner of public works in your city so that he may be present at the same time if he desires to appear, and oblige,

Yours, very truly,

JAMES A. TAWNEY.

BUFFALO, N. Y., December 1, 1914.

HON. JAMES A. TAWNEY,
Winona, Minn.

DEAR SIR: Thank you very much for your courteous letter of November 26. I have sent three copies of my statement to each of the secretaries.

I fully appreciate the wisdom of the policy of the commission which you point out. However, it seems to me that the question here is what is the best way for all concerned to prevent the pollution of the boundary waters by sewage and not what individuals or corporations or municipalities desire. If it be determined that there is pollution which should be prevented, international obligations and public safety require that it should be stopped. Unless the principal municipalities affected furnish the commission with plans for remedying existing conditions which appear to you as proper and effectual, it would seem that the commission itself should make such recommendations for the abatement of the nuisance as it deems best.

So far as the situation in Buffalo is concerned, I may say that I have heard no opposition to the plan of the Erie & Ontario Sanitary Canal Co., except that there has come to my ears a sort of sub rosa effort to defeat it in the interest of certain new power projects. So far as I have been able to ascertain the position assumed by the authorities of Buffalo, it is one of doubt and not of opposition, the doubt being whether the Erie Canal branch proposed would be sufficient for the dilution and carrying off of the sewage which would be emptied into it. Both the commissioner of public works and the deputy commissioner have stated in substance that the plan would be a great relief to the city if it would care for the sewage, and neither one has, to my knowledge, formed or expressed an opinion that the plan proposed would not efficiently care for the present sewage or its increase for many years to come. It is extremely difficult to get official action by the authorities of the city, as they evidently do not care to commit themselves to the feasibility of my plan. I will call the attention of the mayor and common council to the matter and ask for their action, but whether they can be induced to pass a resolution approving our plan or a similar plan is doubtful. It is perfectly true, however, that our city authorities will not present any other plan which commits the city to the expenditure of any considerable amount of money.

If it is possible I will have the honor of appearing before the commission December 14, but the condition of my health and press of business are such that I doubt very much whether I shall be able to be in Washington on that day.

I will ask the commissioner of public works, in any event, to appear before you, so that you may have the benefit of his views whether I am present or not.

Yours, very truly,

GEORGE CLINTON.

The CHAIRMAN. Mr. Bowen, I find here, on page 77 of the preliminary report of this subcommittee on the pollution of boundary waters, this sentence in a letter from W. H. Bixby, Chief of Engineers, United States Army:

It is recommended that Mr. Bowen be informed that, in view of the fact that Congress has under consideration the questions relating to Niagara power and

the action which that body will take on the subject is uncertain, the department declines to grant any permits for diversions of water from the Niagara until after further legislation by Congress.

Do you mean to say that the engineers have reversed their position in regard to that matter?

Mr. BOWEN. I think that statement was in a letter to the Secretary of War. What was the date of that, please?

The CHAIRMAN. March 3, 1913.

Mr. BOWEN. In August, 1913, the President called upon the Attorney General for his opinion as to whether or not he had power under the treaty without act of Congress to proceed in the matter, and Mr. Tawney has before him, I think, a copy of the decision of the Attorney General in that regard, which states that an act of Congress is not necessary; and, by the way, that is the attitude I have taken myself personally from the very beginning of this matter, that under the treaty, the treaty being a paramount law of the land, the President and the departments have sufficient authority to proceed. That is the reason that I have never in the course of this proceeding introduced any bill in Congress, and the efforts that I have made in Congress have been simply to prevent adverse legislation—legislation like the Alexander bill, which would have given to the existing power companies at the Falls arbitrarily all the balance of water under the treaty.

Mr. TAWNEY. The opinion of the Attorney General applies only to Article V, which deals exclusively with the Niagara situation, and the substance of the Attorney General's opinion is that the treaty being as it is the supreme law of the land on our side of the line, the President is authorized and it is made his duty to execute the laws of the land, and he can execute this treaty in respect to diversions. But before this commission could take any action in the matter, would it not be required even then that you obtain permission from the President of the United States for this diversion subject to the approval of this commission?

Mr. BOWEN. Undoubtedly. The War Department has promised hearings upon this matter irrespective of Congress, if Congress does not act in the matter in the immediate future. In fact, that promise was made before the adjournment of Congress in October, and I think it stands open at the present time.

It may not yet have come to the attention of the commission that last May—May 19, 1914, to be exact—a bill was introduced in the House of Representatives by Mr. Mann. That bill is so short that I will read it. It is as follows:

A BILL To protect the water supplies of cities and towns around the Great Lakes, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That hereafter no common carrier operating vessels, craft, or other vehicles, or structures for the purpose of navigation, shall discharge or cause to be discharged sewage or any other noxious material into the waters of the Great Lakes and their connecting waterways.

SEC. 2. That no common carrier operating on the Great Lakes shall provide on steam vessels, for the use of their crews and passengers, water supplies containing organisms or materials liable to cause disease of man.

SEC. 3. That the Secretary of the Treasury shall have authority to make regulations for the enforcement of this act.

That may be of assistance to the commission in its consideration of the pollution by vessels. Reference has been made, but not specifically, to the proposed regulating dam that would hold up lake levels, the special reference containing the final report on waterways from the mouth of the Illinois River by the Board of Army Engineers is House Document No. 762, Sixty-third Congress, second session. In that document the report signed by Gen. Bixby and his associates points out that to compensate for the reduction of level in Lake Erie the outflow capacity of the Niagara River must be diminished by building submerged weirs or construction works a short distance below its head. It shows just how the level of Lake Erie can be compensated for any such diversion as this 6,000 cubic feet.

I will now ask you to listen to Gen. Gorgas for a few minutes.

STATEMENT OF BRIG. GEN. WILLIAM C. GORGAS, SURGEON GENERAL, UNITED STATES ARMY.

The CHAIRMAN. Gen. Gorgas, we would be very glad to have you throw any light that you may be able to on this question of pollution and its remedy, especially as applied to the city of Buffalo.

Gen. GORGAS. The only knowledge I have of the matter is from looking over the papers on file in the office of the Chief of Engineers on this subject. Some two or three months ago the matter was brought up and I had occasion to get those papers out and read them. I presume that my opinion with regard to the matter would only be of value in expressing my view as to whether the sewage of Buffalo could be carried off in this manner and whether its being emptied into the lake in that way would be deleterious.

The CHAIRMAN. Have you any idea as to whether it would be the most economical and effective method of disposing of the sewage?

Gen. GORGAS. No; I did not go into it from that point of view at all.

The CHAIRMAN. So that your knowledge of the whole proposition is only theoretical?

Gen. GORGAS. Entirely so, as I gathered it from those papers and on that point.

The CHAIRMAN. You are not able to state whether the comparative cost of disposing of the sewage in that way would be above or below what it might be by a process of sedimentation or chlorination installed by the city itself?

Gen. GORGAS. I had not thought of that comparison. I would think the actual carrying it off by such a canal after the canal itself was constructed would be cheaper, but I would be always in favor of sewage, before it got into the streams and lakes, being treated. If this canal were used, I would think that the sewage, either before it got into the canal or before the canal reached the lake, ought to be treated in some way.

Mr. GLENN. The canal being built across from Buffalo to Lake Ontario is a perfectly feasible proposition, is it—that is, for taking the sewage of that city?

Gen. GORGAS. That would be an engineering question that I have not gone into.

Mr. TAWNEY. Gen. Gorgas, have you considered the proposition from the standpoint of dilution of the sewage—that is, in diverting

this quantity of water down through the canal and discharging the raw sewage into the canal, would there be sufficient water for a sufficient distance to deliver the water into Lake Ontario in a reasonably sanitary condition?

Gen. GORGAS. Not in detail as to any actual ratio that it would be, but my opinion is that there would be no objection as far as the actual flow is concerned.

Mr. TAWNEY. Will you give the commission your view on the subject from the standpoint that you have been studying?

Gen. GORGAS. Whether the sewage entering into such a canal would be objectionable from a sanitary standpoint to people living on the banks of the canal if they did not treat the water?

Mr. TAWNEY. Yes.

Gen. GORGAS. I would not like to use it as a water supply.

Mr. MAGRATH. Will you also express your opinion as to whether this sewage should be treated, even though it were dumped into that canal?

Gen. GORGAS. On general principles I would be in favor of its being treated before it got into the water supply. I do not think there would be any objection to the flow.

Mr. POWELL. It would not be a nuisance?

Gen. GORGAS. No; it would not be a nuisance.

The CHAIRMAN. Do you think that such a canal as we are speaking of would objectionably contaminate the waters of Lake Ontario, provided there were no process of purification other than dumping it into this canal and running it down through it?

Gen. GORGAS. The same question came up at Panama with regard to the use of our lake there. I took the ground there that we ought not to allow any sewage to go into the lake until it had been treated. As a matter of actual injury, I do not think the risk would be great if we had to do it, but if I were asked to express an opinion and had the power to control the matter I would say that the sewage ought not to go into a great body of drinking water like the lake until it had been treated so as to make it more or less innocuous.

Mr. GLENN. This water course being about 30 miles long and emptying into Lake Ontario where there is no one living and no one taking water, where it emptied into the lake would there be much danger of contamination?

Gen. GORGAS. I think the danger would be very remote, but I was just enunciating the general principle that I would like to see observed with all our lakes.

Mr. MIGNAULT. That is to say, you would like to have the sewage treated before it goes into the canal at all?

Gen. GORGAS. That would be a good way, and I imagine the most economical way. I would think that if the canal water were used for drinking purposes it would be immaterial where it was treated before it got in.

Mr. GLENN. Mr. Bowen, did you not state that if it were found necessary your company would treat the water before it went into the lake?

Mr. BOWEN. Absolutely; yes. The sedimentation feature of this canal is very important, because there are reservoirs all the way down the canal, in the course of which, if the sedimentation and bacteriological action is not sufficient, other chemical means can be

used to purify it before it goes into Lake Ontario, and that is one of the conditions that we promised to submit to the board of public health or whatever board will have control of this. It can make its conditions and we will follow those conditions, so that the water will not go into Lake Ontario until it is rendered innocuous and harmless.

Mr. MAGRATH. Gen. Gorgas, do you believe that this canal scheme in the interest of public health is a sound proposition?

Gen. GORGAS. I think so, from the general idea that I got from those papers.

Mr. MAGRATH. Having that view, do you think it is in the interest of public health and in the interest of the public generally that a canal should be owned and controlled by private interests or by the public if it is for the purpose that has been referred to?

Gen. GORGAS. I do not know that I had thought of that phase of the question. It struck me, in reading the proposition, that the lake at about the head of the Niagara River was contaminated by a good deal of sewage coming in from the various towns; that this canal would take the sewage of Buffalo away, and if it were treated would get it into Lake Ontario in a harmless condition, and, therefore, would be of benefit to public health by that much; that it would take sewage that now goes into the lake untreated and carry it off into another lake in an innocuous condition. As to the question of public or private control, I had not thought of that, but it would seem to me that that is very important. The public could inspect it and see that the conditions were carried out. It would seem to be like any other function that can be controlled by public officials.

Mr. TAWNEY. If this were owned and operated by private interests and the sewage of Buffalo were treated by the owner of the canal, would Buffalo have the same interest in seeing that the regulations were executed and carried out that it would have if it were itself primarily responsible for delivering that water in a reasonable state of purity into Lake Ontario?

Gen. GORGAS. Do you mean, if I were answering the question as though I were the health officer of Buffalo?

Mr. TAWNEY. Yes.

Gen. GORGAS. Of course, as health officer of Buffalo I would not have any interest, as far as the health conditions of Buffalo were concerned, in what became of the sewage after it got away. It seems to me, as an honest and upright public official, I ought to take interest enough to see that it did not get into Lake Ontario in a way that I thought was harmful.

Mr. POWELL. Would it not be an awful tax on a purification plant to purify by sedimentation a flow of water that would be equivalent to 6,000 second-feet?

Gen. GORGAS. I do not think it is looked upon as being any limit to the amount of sewage that can be taken care of in that way, and there are various degrees of purity. I had in mind, when I spoke, something like septic tanks. Possibly my views could be better expressed by what I recommended at Panama with regard to the sewage of the little towns. My idea down there was that the sewage should all go through septic tanks and run out with all the solid matter settled, a clear nonodorous discharge, but that effluent as it came out would not by any means be safe to drink. Such an effluent

coming into the lake and flowing down some miles before it got there, in so big a body of water, I looked upon it as practically harmless for drinking purposes. That would be my general view.

Mr. POWELL. I have made a hasty calculation. There would be about 360,000,000,000 gallons of water to be purified. That would require an extensive plant, would it not?

Gen. GORGAS. After it got into the canal?

Mr. POWELL. Yes.

Gen. GORGAS. Yes. I imagine it would be much cheaper to purify it before it got into the canal.

Mr. POWELL. I think Detroit consumes somewhere about 100,000,000 gallons a day. Buffalo would consume somewhat less. That would be several hundred times, at least, the sewage and water consumption of Buffalo that would have to be purified. That would be an enormous task, would it not?

Gen. GORGAS. It would strike me as being more economical to do it before it got in there.

Mr. POWELL. In the case of the Niagara River, this sewage is very much diluted by the large flow—about 200,000 second-feet. That large flow causes a general movement of the water down, we will assume, through the central portion of the lake. It would not follow the littoral wash or the shore. You can see what effect the current would have on purification. If you should dump this 6,000 second-feet in a quiet part of the lake it would accumulate and be a nuisance there, would it not?

Gen. GORGAS. Where it emptied into the lake?

Mr. POWELL. Yes.

Gen. GORGAS. I would not think it wise to drink it, but I do not think the sewage of such a city going into a big lake, like Lake Ontario, would make a nuisance in the way of bad odors and disagreeable conditions of that kind.

Mr. POWELL. In that lake, apart from the general setting of the current in the central portions of the lake, the waters would be quiet or still. Would not the pouring of the large amount of sewage into that dead water create a nuisance unless it were pretty well purified?

Gen. GORGAS. I was trying to think of some instance where similar conditions existed—where sewage was put into still water. I can not think just now of any such large amount of sewage going in, but my general opinion would be that it would not be troublesome.

Mr. GLENN. The lake is not so very still, is it?

Mr. POWELL. Well, it would be in the central portions.

Mr. GLENN. But this water has run about 38 miles before it has gotten into the lake.

Mr. POWELL. That would not help it very much.

Mr. GLENN. The slower it runs the better it purifies.

Gen. GORGAS. I have been so impressed with the other phase of health—looking for particular causes—that I have never paid much attention to the bad odors from the health point of view, except in so far as they constituted a nuisance and the people complained of them.

Mr. POWELL. Even in New York, where they have the tidal action and the current of the Hudson River, the enormous outflow of sewage is creating a nuisance.

Gen. GORGAS. I know of instances such as that at Habana where the sewage emptying into the bay would produce a nuisance in the way of floating material, barrels, staves, and a dead animal now and then that would be washed ashore, but there was not any in the sense of the mere diluted sewage giving us trouble in those ways. But of course that was a very small body of water, and I think I recollect seeing some complaint being made about conditions at the mouth of the New York Harbor—Coney Island refuse, for instance, being washed up in former days. There might be some objection on that point. As I said, if I had control I would insist upon it being treated.

Mr. POWELL. You plant yourself on the broad general principle that a body of water that is used as a source of drinking supply should not be contaminated by having sewage dumped into it in any way?

Gen. GORGAS. Untreated sewage; yes; that would be my general view. I would always urge that where I could.

The CHAIRMAN. Gen. Gorgas, we are very much obliged to you for coming before us and giving us the benefit of your views on this subject.

Gen. GORGAS. It has been a very great pleasure, Mr. Chairman, to express my views.

The CHAIRMAN. Mr. Bowen, have you anyone else that you want heard?

Mr. BOWEN. Not to-day. From some expressions that have been made here, I take it that there is going to be a meeting in Buffalo within the near future.

The CHAIRMAN. That has not been determined yet. That is, no definite time has been fixed. Unquestionably there will be a meeting at some time in the future.

(The commission thereupon adjourned, to meet again Wednesday morning at 10.30 o'clock a. m. for further consideration of this subject.)

WASHINGTON, D. C., *Wednesday, December 16, 1914.*

The commission met at 10.30 a. m., all the members being present.

There were also present Prof. Earle B. Phelps, of the United States Public Health Service, and Dr. Harvey W. Wiley, of Washington, D. C.

Mr. BOWEN. Mr. Chairman, there is one statement I think I left unsaid with regard to the levels. The profile on file with the commission shows the 8-foot drop from Lake Erie east of Buffalo, at the junction of the Buffalo River; but it is our intention to run that 8-foot lower level clear to Lake Erie and place the regulating works at the entrance from the lake, so that there might not under any circumstances be any backwater through those creeks into the lake or river, the 8-foot lower level than the lake extending all the way down to Lockport, and being low enough to take in all of the sewers of Lackawanna, Buffalo, and the Tonawandas; and, in fact, all of the cities on the line.

The CHAIRMAN. There is one thing, Mr. Bowen, that I can not seem to get through my mind, and that is how you are going to

reverse the current of Buffalo River and turn it the other way without endangering the level of Lake Erie.

Mr. BOWEN. The same as they have done in Chicago. The Chicago River runs from Lake Michigan to Lockport, 32 miles, with a slight current toward the Mississippi River. The Buffalo River would run from Lake Erie to our canal east of Buffalo with only a slight current of about a mile an hour eastward instead of westward into Lake Erie, and the city of Buffalo has bonded itself to extend a ship-deep waterway clear to the city line from Lake Erie, and a very slight difference in the dip from what it is now from east to west, making it from west to east, will reverse the flow, just as the flow of Tonawanda Creek is being reversed by the State of New York.

The CHAIRMAN. That would not affect the lake level in any way down at Tonawanda, but up at the mouth of the lake it seems to me that if you change the course of a river from running into the lake to the reverse that that necessarily would tend to affect the level of the lake.

Mr. BOWEN. Whatever difference there is caused by the diversion of this 6,000 cubic feet will be taken care of by us at our own expense according to engineering plans that the Government will approve of. I referred to one such plan in one of the House documents on Monday. Other plans have been from time to time made, so that there is not any one set way of maintaining the level or recompensing for any diversion of water from the lake.

Mr. MAGRATH. You said the other day that if necessary you would construct a submerged weir in the Niagara River to compensate for the withdrawal of water down your canal. Have you any idea what that would cost you?

Mr. BOWEN. The estimate is in that House document which I referred to. I left it in my room this morning, not having notice that there was to be a further meeting; but information in reference to that is on file, and, if I remember correctly, it is \$150,000.

Mr. MAGRATH. Then with regard to discharging the sewage of Buffalo and those other centers below into your canal; under what arrangements would you propose doing that?

Mr. BOWEN. A contract with each municipality, and they to furnish only the connecting of their city systems with this new outlet and receiving the benefit of our canal free and without any charge for the disposal of their sewage.

Mr. MAGRATH. I understand then that your scheme is to have them connect their sewage systems with your canal at their own expense and that you will then take off the sewage without any further expense to them?

Mr. BOWEN. Yes.

Mr. MAGRATH. Did I not also understand you to say that if called upon to do so you would treat that sewage at your expense?

Mr. BOWEN. At any time that either Government finds that there is any nuisance entering Lake Ontario it is a condition of our permit, as the Secretary of War will issue it, that we will, at our own expense, take care of that and carry out any rules of the department of health of either country that are insisted upon.

Mr. MAGRATH. In making a statement of that character have you considered what it will involve you in financially?

Mr. POWELL. Do you mean the purification, Mr. Magrath?

Mr. MAGRATH. Yes.

Mr. BOWEN. The purification, first, in the course of 38 miles from Buffalo and 42 miles from Lake Erie to Lake Ontario, the purification by natural processes such as sedimentation and bacteriological action and insulation and other biochemical processes will probably, for years to come, be sufficient; and when it is proved necessary to further purify the effluent before it empties from our last reservoir into Lake Ontario, we suppose that a chlorination process will answer every purpose as being by far the most economical chemical process that has been found. The cost to Buffalo for all of its water supply is only a few dollars a day. In the reservoirs that we will have at Lockport and below there will be ample opportunity while the water is allowed in those reservoirs to carry on any such system of chlorination or whatever other process seems to be necessary. In talking over the matter with Gen. Bixby I suggested that the violet ray would answer the purpose. "Yes," he said, "that would answer the purpose, but it would be more expensive to use up your electricity in that way than it would be to carry on a chlorination process." But whatever process is carried on we do not anticipate that it will eat into the total income to any great extent.

Mr. MAGRATH. So you have made no estimate as to what sewage treatment would cost you if you should be called upon to treat it?

Mr. BOWEN. That is impossible at this time, I think, because it is so uncertain what amount of further purification may become necessary in the future.

Mr. MAGRATH. What occurs to me, Mr. Bowen, is this: You are making statements that you are prepared to do certain things. Now, you can not do them beyond your income.

The CHAIRMAN. Is it in your mind, Mr. Bowen, to operate this canal, supposing that it should be constructed, in the same way that they are operating the Chicago Canal?

Mr. BOWEN. No; because there they have never dredged out the sludge from the time they opened it in 1901 to the present time. We anticipate that we will dredge out the sludge frequently from our canal so that there will not be such a measure of contamination as there is in the Chicago Drainage Canal, and it will be many, many years in the future before we are called upon to take care of any volume such as they take care of now or did take care of in 1901. Furthermore, they have never anticipated any purification at all except by natural means in the Chicago Drainage Canal.

Mr. MAGRATH. How much horsepower do you anticipate developing on that canal?

Mr. BOWEN. Our estimate based on 80 per cent efficiency is 170,000 and some hundred horsepower from the 6,000 cubic feet.

Mr. MAGRATH. The estimate of cost of the construction of the canal you have given, have you not?

Mr. BOWEN. That was made before the present improved methods of excavation and we estimated at the beginning of our promotion the total cost, including the cost of carrying charges until our income would be assured, as \$30,000,000, but, as I was reading yesterday in the Engineering News, the cost for digging irrigation systems now has been reduced by this new method of drag-line excavators

from \$1 a cubic yard to 12 cents a cubic yard. I am informed by engineers that contracts for plain excavation has reached 5 cents per cubic yard. Our estimate was based upon 85 cents per cubic yard for all of the rock cutting, and I think 40 cents for the earth cutting. I think I have in my pocket an estimate showing that the whole of the average cutting of our canal would reach only from 6 to 7½ cents, and that is the estimate made by one of the most responsible concerns in the country. You no doubt know of the Lidgerwood Manufacturing Co. With the new drag-line excavators they can take care of all of our excavation, blasting the rock according to the most modern methods, so that it can be carried out by their drag-line excavators instead of by the old style steam shovels, and that reduces the cost, as they say, from 2, 6, or 7½ cents a cubic yard, whereas our estimates were made for 35 to 40 cents per cubic yard.

Mr. MAGRATH. Was your estimate of \$30,000,000 based on 35 to 40 cents for earth excavation?

Mr. BOWEN. Yes. I will just read into the record one clause of this letter:

The capacity of drag-line excavators like other digging machinery depends entirely on the conditions surrounding them and also the size of the excavator. We consider, however, a conservative estimate of their capacity one bucketful per minute average, and work which is probably similar to the character which you anticipate doing is being done in this country with drag-line excavators at from 6 to 7½ cents per cubic yard, including the carrying cost and other expenses incidental to excavation contracts of the character you anticipate.

Mr. POWELL. In what region is that?

Mr. BOWEN. It says our country, the United States. The letter is from the Lidgerwood Manufacturing Co. of New York.

Mr. POWELL. It may refer to some prairie section.

Mr. BOWEN. No. The description which they estimated this on was one-third rock of our own right of way and two-thirds drift and other material.

Mr. MAGRATH. So you think your estimate of \$30,000,000 would be reduced?

Mr. BOWEN. It would be reduced one-third.

Mr. TAWNEY. In order to find out what the cost of the canal would be, Mr. Bowen, what investigation have you made with respect to the material that you would have to excavate?

Mr. BOWEN. The United States Government—

Mr. TAWNEY. I am asking what investigation your company has made directly on the ground.

Mr. BOWEN. We have depended, except for the survey, as we have walked back and forth, Mr. Randolph and our other engineers, over the route, and the observation of the outcroppings and all the material that is shown by bacteriological surveys, both State and national.

Mr. TAWNEY. Have you done any drilling yourselves?

Mr. BOWEN. We have depended upon Government drills.

Mr. TAWNEY. The Geological Survey does not do any drilling, does it?

Mr. BOWEN. No.

Mr. POWELL. Have there been any soundings made in order to find the depth of the earth?

Mr. BOWEN. The Government did. I showed you the other day a map showing five different ship routes, one of them following very closely our route from Tonawanda to Olcott, and along that route the Government has records which we have had the use of in forming our estimates.

Mr. TAWNEY. Mr. Bowen, how much is your company capitalized for?

Mr. BOWEN. One hundred thousand dollars, and just enough for promotional expenses, and we have not used nearly all of that yet.

Mr. TAWNEY. How much is paid in?

Mr. BOWEN. The capital stock issued amounts to between \$58,000 and \$59,000.

Mr. TAWNEY. Paid in?

Mr. BOWEN. Paid in in services and in cash.

Mr. TAWNEY. How much in cash?

Mr. BOWEN. A comparatively small amount—less than \$10,000 in cash, the balance having been paid in lieu of cash to the engineers and experts for their services.

Mr. TAWNEY. How much of your bonds are you authorized to float?

Mr. BOWEN. That authorization has never been called for, and we are waiting to get a permit before we do anything of that sort, as it would not be of any effect at all until we get the permit.

Mr. TAWNEY. Do you know whether you can float the bonds if you have the permit?

Mr. BOWEN. We made a contract for the floating of the bonds before we took any other steps toward engineering. We made a contract with a responsible man in Chicago, an expert bond man, whose father and brother were connected for very many years with the Commercial Bank of Chicago; that is, Mr. W. W. Vernon, whose reputation in such matters is unimpeachable. We made a contract with him for converting or selling the bond issue on a basis of 2 per cent commission, not underwriting, but a contract for the selling, he to take the expense on a 2 per cent commission.

Mr. TAWNEY. What is the aggregate amount of bonds that you contemplate issuing?

Mr. BOWEN. After the permit is issued, of course, we will make more careful investigations as to the actual cost and issue the bonds upon the actual cost at that time, not issuing \$30,000,000 arbitrarily, but only such amount as would be absolutely necessary for construction.

Mr. TAWNEY. Will it be necessary for you to secure additional legislation from the State of New York before you issue these bonds?

Mr. BOWEN. None whatever; but if the State public-service commission desire us to appear before them at the present state of affairs we are willing to do so. I filed here the other day our articles of incorporation which show that we are organized as a business corporation and are not under the public-service law. We have done that so as to make the company available for other uses than simply the generation and distribution of electricity, and being organized under the business corporation laws of the State of New York we are authorized by that same law to issue such bonds as are reasonably necessary for the business. Afterwards, when it comes to the

point of actual distribution of power, then the public-service commission would have to take jurisdiction through a subsidiary company.

Mr. TAWNEY. When was your charter obtained from the State of New York?

Mr. BOWEN. I think the date is about September 1, 1908, and I have made annual statements to them ever since.

Mr. TAWNEY. Was not your charter an old charter that you obtained by assignment?

Mr. BOWEN. Not by any means. I went to the secretary of state in Albany to consult with him in regard to the form of the charter before we signed it and filed it with the secretary of state, and it was accepted by them as a new going concern. It has been recognized as such in the State of New York ever since, and we have made our annual statements to them.

Mr. TAWNEY. Have you included in your estimate of the cost the right of way?

Mr. BOWEN. Yes, sir. We have to go through mostly farming lands and we have under our charter the right of eminent domain, so that any reasonable price for this farming land we will pay. We hope to get most of it without exercising the right of eminent domain, but if it is necessary at any point to use that right we have it.

Mr. TAWNEY. What is your estimate of the cost of the right of way?

Mr. BOWEN. Between \$1,000,000 and \$2,000,000. There will be about 4,000 acres of farming land, and much of it through the swampy land that is cold and sour by reason of its being in the bed of a prehistoric lake is obtainable at \$50 an acre. We will improve the whole of that region by reason of our ability to drain it and make the cold and sour land into good productive land; and, furthermore, our surplus water from the reservoir at Lockport will be used below Lockport on all of the lower levels to Lake Ontario for irrigation purposes if it is found desirable by the farmers to use it for that purpose.

Mr. TAWNEY. As I understand you, then, your corporation has an authorized capital of \$100,000?

Mr. BOWEN. Yes, sir; and that under the law could be increased if it should become necessary.

Mr. TAWNEY. But at the present time there is less than \$10,000 paid in?

Mr. BOWEN. I would not put in that way. A fairer way of putting it would be to say that the cash that has been paid in by purchasers of stock and the purchase of services, \$58,000 or \$59,000, has been fully expended.

Mr. TAWNEY. Then, in the neighborhood of about \$40,000 of stock was issued in consideration for services rendered?

Mr. BOWEN. There is \$40,000 left unissued.

Mr. TAWNEY. You say there is \$59,000 in all issued?

Mr. BOWEN. \$58,000 or \$59,000.

Mr. TAWNEY. Then, about \$50,000 was issued for services?

Mr. BOWEN. Yes, sir.

Mr. TAWNEY. That stock has been issued, has it?

Mr. BOWEN. Yes, sir.

Mr. TAWNEY. And there was about \$9,000 for cash, which would leave you about \$40,000 of your present authorized capitalization.

Mr. BOWEN. For further expenditures; yes, sir.

Mr. MAGRATH. My difficulty, Mr. Bowen, is this: We have the Niagara River, with some 250,000 second-feet of water passink down, into which there is discharged the raw sewage from certain centers along that river. You come forward with a plan, telling us that you want to discharge that sewage into a canal carrying 6,000 second-feet and we have not got any clear statement from you that you propose treating that sewage in that canal any differently from the way it is treated in the 250,000 second-feet channel.

Mr. BOWEN. That is answered, in part at least, by the testimony of Dr. Lucian W. Chaney taken here two years ago. He describes the whole length of this canal as a septic tank and, being a slow-running stream, it will purify itself, as in a septic tank, more thoroughly than in a swift-running stream even of larger volume, like the Niagara River. The scientific reasons for that better purification in a slow-running stream perhaps Dr. Wiley can explain further than Dr. Chaney has explained. I think the other experts have referred to the probability that in that length of flow there will be sufficient purification.

Mr. MAGRATH. But you have not stated that if that is not satisfactory to the countries your company proposes doing those things that will be sufficient to make it satisfactory, and I do not think you are justified in making that statement, if you will permit me to say so, unless you are in a position to say what it is going to cost you. At least I think it is an unwise statement to make—that you are prepared to do things which may involve you in a great expenditure of money.

Mr. BOWEN. I think it is safe to trust us to do that, because it will be one of the conditions of our permit, and the advance in chemical means of purification every year is so great that probably rather than costing more in the future it will cost a good deal less.

Mr. POWELL. Of course, your stream is running slowly and the Niagara River runs rapidly, but if the process of purification after two ways—first, by sedimentation, and, second, by dilution, where the dilution would be forty times the dilution in your canal—results in this state of affairs, that it poisons the waters of Lake Ontario for about 20 miles so that it must be cleansed, how are you going to get clear of treating practically your whole flow at all times?

Mr. BOWEN. Whatever it may be we are satisfied that it will not be too great a burden upon us, and chemists can tell just what that will be at the time it is necessary. Until it is necessary, and is demonstrated to be necessary it ought not to be a requirement placed upon us.

Mr. POWELL. What is the average cross section of the canal? Of course, it will vary according to depth?

Mr. BOWEN. Yes. In the lower reaches, in order to provide for flood waters and the sewage of the different towns, it will be 20 feet deep by 125 feet wide.

Mr. POWELL. To give you a capacity of 6,000 second-feet you must have quite a rapid stream in that section.

Mr. BOWEN. I trust to the engineers, because that has been very carefully worked out.

MR. POWELL. Assume your first estimate, which you stated was \$30,000,000. Now, you would have to capitalize, of course, the expense of purification, and you probably would add some millions more to that amount.

MR. BOWEN. I do not think so, because that will come out of our income.

MR. POWELL. Well, your only income is from the power, is it not?

MR. BOWEN. No, sir. There will be many sources of income from this. It is extraordinary in giving opportunity for other income.

MR. POWELL. In what way?

MR. BOWEN. At the harbors at either end there will be warehousing and transferring and terminals.

MR. POWELL. You would use it for purposes of a canal, of course?

MR. BOWEN. Not only for a canal but for terminals connecting all of the factories. We expect to use the surplus power for factories on our own right of way.

MR. POWELL. Is not the Erie Canal practically free from toll to-day?

MR. BOWEN. We do not charge any toll for the canal.

MR. POWELL. Where does your income come in?

MR. BOWEN. It is in the warehousing and terminals. We join three elements in this development. We meet lake and rail and lake and canal and warehousing, and my development of this plan was based upon a knowledge of the industrial necessities of the Niagara frontier. I organized in Buffalo an industrial association in 1901, and for seven years I gradually absorbed enough of the necessities of the industrial life there to formulate and carry out this plan as an industrial proposition first. Then came the success of the Chicago Drainage Canal in reducing the typhoid rate, and I saw my opportunity to organize this company in joining the industrial with the health-conservation elements.

MR. POWELL. What do you estimate the worth, the market value, of your electricity per horsepower at the indicator at the power house?

MR. BOWEN. One-third of 1 cent per kilowatt hour. I have been attending the meetings of the scenic committee on public lands on this water-power matter, and the lowest estimate of any of the witnesses has been 2 cents a kilowatt hour. I estimate that 1 cent a kilowatt hour produces between \$60 and \$65 a horsepower a year and one-third of 1 cent \$20 a horsepower a year, and on the basis of \$20 a horsepower a year is our income. Of course it will be greater than that, but in order to be absolutely conservative we have only based it on that.

MR. POWELL. Assume that you can and do sell more horsepower than you manufacture. Your income would only be about \$3,000,000 at the very outside. Supposing you were selling the full electrical product. Now, if that development costs about \$50,000,000, you would find that it did not pay. However, we can not go into those details.

MR. TAWNEY. It has some bearing, however, Mr. Powell, on the question of the practicability of the proposed scheme.

MR. BOWEN. I can assume, I think safely, and I think you can assume, that the reputation of the men that I have secured to con-

nect themselves with this enterprise is based upon their actual knowledge of conditions and that they are safe and conservative men.

Mr. TAWNEY. It is on facts, however, that we must base our conclusions, and not on the reputation of men.

Mr. BOWEN. The facts have been set forth in the papers that have been filed with you.

Mr. POWELL. Some very able and far-sighted men have participated in gigantic fizzles commercially. Somebody said it only took a great man to make a big mistake.

Mr. BOWEN. Dr. Wiley, would you answer now some questions that they may ask you?

STATEMENT OF DR. HARVEY W. WILEY, OF WASHINGTON, D. C.

Dr. WILEY. Mr. Chairman and gentlemen of the commission, I know nothing about the engineering features of this proposed purification system. I do have some expert knowledge of the methods of purifying sewage waters and I have a great deal of feeling in regard to the necessity of sewage purification. The earlier principles of the purification of water, of course, were entirely erroneous; that is, the fundamental principles of the earlier sanitary engineers and chemists. It was thought that water was purified by motion and oxidation. Water is purified by the action of organisms of a supposed vegetable character, and the rapidity of motion instead of favoring purification hinders it to a certain extent. The principle involved in rapidly moving water is dilution, the spreading evenly of the infected material throughout the large mass, apparently leading to purification.

The necessity for the purification of running water is growing greater every year from a sanitary point of view. Many of the streams in this country are already undrinkable, many of them are unfit for water diet, and the turning of all our running streams and rivers and lakes into sewers is a threat to the health of the people who use those waters.

The fundamental principle of the purification of city water is the septic tank. There are other methods of purification. Simple filtration is one. Sand is the best filtering medium. Sedimentation and filtration is another method; I mean mechanical sedimentation. Chemical sedimentation and purification is another method. All of these methods are effective according to the character of the water that they purify and the facilities for handling. A fourth method is one which would be ideal if it could be used, and that is the use of the polluted waters for agricultural purposes. The waters carry a great deal of plant food, which ordinarily is carried on to the sea. Of course it is not entirely wasted, because we recover a great deal of it in our marine plants and in marine animal life. Probably none of it is forever lost, but it may be many millions of years before a lot of it ever becomes available again. However, that part of it does not interest us very much. The need of the farmer to-day is material that he can use and not that his grandchildren of remote generations can get at. So letting the waters run into the sea, which is the final method when all other methods fail, is from the economical point of view the least desirable.

Two fundamental points it seems to me should be kept in view—better health and the saving of agricultural wealth. The slowly moving stream, of course, affords better facilities for the purification by the action of organisms than a more rapidly moving one. The ideal method of purification is to have the water still. That permits the growth of the organisms more vigorously and provides a much better and more complete system of purification. With still water under proper conditions of temperature and the materials on which it rests, you would be surprised at the remarkably rapid operation of these organisms. In the course of three or four hours the dirtiest sewer water may be drawn off, as far as appearances are concerned, limpid and suitable for consumption. In fact, so far as any living organism of matter that carries infection is concerned, it is practically pure. I once induced myself to drink sewage out of a purification plant that had been in there only four hours. That was near Berlin. I did not drink very much of it, but I did take a sip to show that I had faith in my theory of purification.

Mr. POWELL. That was near Berlin, Germany?

Dr. WILEY. Yes. We do not care to purify our sewage for drinking purposes, but we do want to purify it in such a way that it is not a threat to the people who have subsequent use of the water. The principles of riparian rights used to be confined wholly to the uses of water for power and irrigation purposes, but the principle of riparian rights should also protect the health of the man who lives below. It is just as much a right to be well and free from sickness as it is to get rich.

Any system that proposes to take the sewage of Buffalo and after a time throw it below must be based upon fundamental principles of purifying that sewage so that it will not pollute the waters of the lake into which it runs.

I know very little about this matter except what Mr. Bowen has told me. I have been interested in it from a sanitary point of view. We have a number of large cities on our side of Lake Erie. There are Toledo and Detroit which are almost at the beginning of it, and then Sandusky and Cleveland and Erie and Buffalo, as well as a large number of smaller towns. All of them have been pouring sewage into the lake, as you know, and with very bad results to the cities themselves that are taking their water also from the lake. The great epidemic in Erie which occurred a few years ago shows the danger of doing that thing. It was found that the intake for the city water was very near the outlet of the sewage system, and the result was a case of auto-intoxication; they were poisoning themselves by drinking their own sewage. The colon bacilli being allied very closely with the typhoid bacilli are found in all sewage waters naturally as a product of the intestinal canal, so that the discovery of colon bacilli in any considerable quantity of water is *prima facie* evidence of fecal or sewage contamination. Those organisms are easily destroyed. They are eaten up by the nitrifying organs particularly, and they are also easily removed by sedimentation and filtration.

Now, the problem of purifying 6,000 cubic feet per second is one of considerable magnitude. In course of time nature does the purification much more rapidly in warm weather than in cold weather, as much as we think to the contrary, but a favorable temperature

assists the activities of the organism to destroy organic matter. Even in waters near the freezing point the action is not entirely inhibitive, though, as I say, it goes on much more slowly. Very often these epidemics of typhoid fever occur in winter. The one in Erie occurred in January, February, and March, when we would not expect waters, as far as our common ideas are concerned, to be contaminated.

The keeping of this sewage out of the Niagara River as a means of protecting the waters of Lake Ontario must rest upon the fundamental proposition of purification en route.

Mr. MIGNAULT. Necessarily.

Dr. WILEY. The slow-moving stream may take many hours more to reach the lake, but if no attempt is made to get rid of the sewage in that length of time, except to leave it to nature, in my opinion it would not be in a proper condition to pour back into the lake. It would be just as bad as if poured into the Niagara River. There it would be mixed with the waters of the whole lake and diluted. In the other case it would be confined and would not be a threat to the people on the Canadian side when poured in on this side, but as far as that is concerned if there were any pollution there it would be a threat to our own people and not to the Canadian people.

Now, sedimentation and chemical treatment are very cheap. Lime and sulphate of iron and chloride of lime and alum, which are the common materials used for chemical purposes, are all cheap chemicals. I have visited a great many establishments. During this last summer I visited Columbus, Ohio, where the water is real sewage taken out of that very small stream compared to the number of people living in Columbus, and where it is purified so that its bacteriologic count is almost nil by chemical sedimentation and subsequent filtration in a very small area.

Prof. PHELPS. That is the drinking water?

Dr. WILEY. The drinking water; yes, sir. It is perfectly wholesome and pure and potable in every way. Of course, that is only a few million gallons a day. I think they use, maybe, 10,000,000, 15,000,000, or 20,000,000 gallons at Columbus. I think they have no difficulty whatever with their small plant in furnishing the water, but if the other water is to be treated in this way and filtered it is a matter of great magnitude which the company has possibly taken into consideration. It is certainly advisable from all points of view to segregate that vast amount of sewage at Buffalo. I think everybody admits that. If you could have a large storage lake or reservoir to pour it all into, and use proper chemical sedimentation, I think it would be a method of handling it which might work very favorably, because the sediments themselves at the bottom become innocuous as a result of the work of the organisms which are most active in purification. In a very few hours vast bodies of water, especially in warm weather, would be rendered practically harmless as far as any threat to health is concerned.

Now, all I have to say is this: As I told Mr. Bowen when he asked me to come here, I want to say a word in favor of the work which you are doing in respect to studying the sources of the contamination of these boundary waters with a view to protecting the health of the people who live on both sides of those waters. Something has to be done with all of these sources of pollution. The cities

themselves may be required by law to purify their own sewage, as Baltimore has been compelled to stop throwing its sewage into the Chesapeake Bay. The best way to get a city to purify is to injure the fishing of somebody who lives below. You may preach to city officials until you are gray on the desirability of protecting public health and they will pay no attention to you, but if somebody loses an oyster bed they will listen to you.

But I am grateful for sanitary measures no matter from what source they come. I welcome the plan which wants to utilize the water; not that I care for that—I do not know anything about it, but if they will purify that water it will render a public service in my opinion, and a very great one there where the waters are brought into a narrow stream and spread raw all through the lake. And they promise that. Of course, I can not judge how they are going to do it. That is their matter, but that is the condition on which they ask for it.

As far as diminishing the grandeur of the Falls is concerned by lowering the level, I know very little about that from an engineering point of view, but I do say that if you can purify that sewage and make it wholesome it is worth taking a little water out of the Falls or lowering the level for an inch or two.

I have outlined in a brief way the methods which they can use. They will want the cheapest and most effective methods for this purpose. They will have to purify this stream both above and below the Falls. I do not think it is a problem that is insolvable. I am sure that it can be done, because cities treat great bodies of water with perfect satisfaction in that way, water which is much more contaminated than this water would be.

Mr. GLENN. Doctor, the amount of sewage drawn from Buffalo in a canal of that size would be a nuisance unless it were treated, would it not?

Dr. WILEY. Yes; unless it were treated it might be highly objectionable, just as it was in the case of the waters at Chicago before they deepened the rivers until it ran out. You are all familiar with the lawsuit in the Chicago case. It was carried to the Supreme Court of the United States. As in many other cases experts did not agree. I never knew them to on any point yet. I suppose the only body that is unanimous is the International Boundary Commission. The difficulty of the sanitary problem is the fact that the sanitary experts do not agree.

Mr. TAWNEY. When you spoke of the International Boundary Commission, you had no reference to this commission, had you?

Dr. WILEY. I do not know what the name of this commission is. This is the commission that I meant.

Mr. TAWNEY. There is also an International Boundary Commission. This is the International Joint Commission, for the settlement of international controversies between the two countries.

Dr. WILEY. I just wanted to mention that because you can get experts who, with perfect honesty, would say that this could not be done. I know it is being done all over the world, and I do not see any reason why it could not be done here. Now, the Chicago case to which I referred was a kind of drawn battle. The Supreme Court of the United States, I believe, did not decide it in one way or an-

other. The people of St. Louis were very much alarmed about the sewage of Chicago. Sanitary examinations were made of the waters between the two cities for the whole distance at varying points. One set of experts said that the influence of the Chicago drainage on the water of the Mississippi where the St. Louis intake was located was imperceptible; it had purified itself completely in the journey, which is some considerable distance, and required many days, so that it was not perceptible. Others said that they could detect a difference. At any rate, the people of St. Louis objected to drinking the Chicago sewage. As far as I know, there is no attempt to purify that water, either by sedimentation or by chemical treatment. I think it is the raw sewage that flows directly into the Illinois River and into the Mississippi River. So there is that great body of sewage which has become practically inert in its journey, and yet it might be a threat after all, because unless certain means are taken to destroy the infection and infecting organisms I think it would be far better that the water have a treatment which of itself would be a certification of purity. If this company can make enough out of its power falls to purify the sewage and still keep going it will be doing not only a service to its own stockholders, but to the public at large. If it can be done, then that purification itself would be a sufficient warrant, it seems to me—and it is off my ground entirely—to permit it to be done. There are some things better than beauty and grandeur in this world, and one of them is an immunity from the threat of disease.

All of our sanitary methods are improving, and some day you will be able to ride in a Pullman car without the danger of carrying infection to your homes—not now, but some day. You will be able to breathe the air of a room that is well ventilated and filled with pure air occasionally, which you do not have, as far as I can see, around this room. I want to encourage these matters all I can, gentlemen. I am here solely for that purpose. If this is a scheme for purifying a vast body of sewage cheaply, and I believe it is, I am for it.

MR. TAWNEY. Dr. Wiley, under the reference by the two Governments to this commission with respect to the pollution of all these boundary waters, the commission is not called upon to, and I do not think it could, recommend any specific project such as is proposed here, but we may consider the advisability of recommending sewage disposal or treatment by means of a canal. Is it your judgment that the treatment of that sewage by means of a canal carrying it from Buffalo, together with the sewage of all the other cities, down to Lake Ontario is preferable to treatment by sedimentation, screening, and sterilization in a plant constructed at the city for that specific purpose? We have nothing to do with specific projects or the promotion of corporations for the purpose of doing one thing or doing anything, so far as that is concerned.

DR. WILEY. I think, of course, that a plant constructed specifically for purification of sewage would be more apt to be perfect and succeed than a plant in which purification was incidental. I do not doubt that at all. But you have to have a canal to collect the sewage to begin with. It has got to be carried somewhere. I assume that in carrying it somewhere the treatment is to be as efficacious as if

that were the sole purpose of carrying it. That is the way it appeals to me, and if that is true and this company is going to do it without expense to anybody, to that extent it is desirable.

Mr. TAWNEY. If the commission should conclude to recommend a canal and the sewage of the city of Buffalo and the cities below Buffalo should be disposed of by the canal, it would not be for this commission to carry that out. It would be for the two Governments to agree upon that plan.

Dr. WILEY. Certainly. The reason I mentioned this scheme was that Mr. Bowen asked me to come here and tell this commission what I thought about the purification of water and its necessity. If there is a better scheme than this, I prefer that better scheme. Cleveland is struggling with this problem. The law of Ohio, I believe, requires that within a certain time the cities cease pouring their sewage into Lake Erie or into the Ohio River; and it is a big problem, which Baltimore has just solved by a huge septic tank which is very successfully operated, I am told. It cost a lot of money; but that is not the question. It means safety and health to the people.

Mr. BOWEN. Dr. Wiley, there is one point that I do not think you have covered, and that is the trade wastes.

Dr. WILEY. I spoke of that right at the start. I looked at sewage from an agricultural point of view.

Mr. BOWEN. On Buffalo River, for instance, there is more than one large chemical plant. Those plants discharge all their trade waste into the Buffalo River, and that waste goes into the Niagara River. I think that has a great effect upon fish life in the Niagara River, because it used to be that Niagara River was a great breeding place for fish, and now, on account of the great pollution, it has been spoiled. If this canal, carrying not only trade wastes but a great deal of sewage that is not collected in any sewer, will divert that Buffalo River in bulk from Lake Erie and the Niagara River, is not that a further benefit?

Dr. WILEY. Well, trade wastes from the manufacturing establishments that I had in mind were such things as sulphur dioxide. They destroy fish life and help purify the water. They would be useful in sewage because of the chemicals which would destroy not only animal life and these vegetations that are harmful to health, but would also impede very seriously purification in a septic tank, because there vigorous plant growth is absolutely essential. So they work both ways, these trade wastes; they destroy the animal life and they impede the nitrification. They hurt the water, but at the same time they help sedimentation and thus favor the purification of water by sedimentation. Nearly all the organisms in water attach themselves to the sediment. They all go down with the sediment; they are in the mud or sludge. And thus sedimentation always helps to purify water in that way, chemically.

Mr. MAGRATH. I am going to ask you a question, Doctor, and I shall ask it with considerable temerity. Has there ever been any attempt made to determine the proportion of cost to the public of water-borne diseases as compared to other diseases? For every hundred dollars that the people pay out in connection with health what proportion of that amount is due to water-borne troubles? Do you understand what I mean?

Dr. WILEY. I think you want to know what proportion of the infection to which we are subject is due to water-borne diseases.

Mr. MAGRATH. That is it. Has any attempt ever been made to work that out?

Dr. WILEY. I think the common belief is now based on evidence which has been secured showing that water-borne diseases are much more to be dreaded than air-borne diseases; that the air is not quite so important a bearer of disease as it was once thought to be. The precautions that are taken to safeguard air, of course, are highly desirable, but our threat is mostly from what we put into our stomachs, our food and water. That is the threat which is most insistent at the present time, and especially is that true of typhoid fever. Typhoid fever is preeminently a water-borne disease. Almost every epidemic that has ever been traced has been traced to that cause. According to the practice of some dairymen it may be borne by milk, too. Alcohol will not carry typhoid. That is one beverage that we can use without the fear of typhoid.

Mr. MAGRATH. What is in my mind is this: We can determine the number of doctors that are living in a city of 30,000 people; we can make an estimate of what the people are paying those doctors, and we can determine what the hospitals in that city are costing the people; so we might be able to fix a per capita amount which the people have to pay on account of sickness. Now of that amount has there ever been any attempt made to discover what proportion is due to water-borne diseases?

Dr. WILEY. I do not know that it has ever been attempted to separate the dollar spent for health for all causes and the dollar lost by reason of ill health. The loss due to disease and the cost of disease must be added to get the true valuation. I do not know that any attempt has ever been made to see what proportion is due to water-borne infection, but from my knowledge of the subject I think I can say safely that fully one-third of the losses due to disease, directly or indirectly, is water-borne. And when the tremendous cost of disease in the loss of labor and activity and the cost of medical attendance are considered it is an enormous bill in every country.

Mr. MAGRATH. What my mind is leading up to is this: When we go to a locality and say, "You should remodel your system of treatment of sewage, and to do that it will cost you considerable money," the nearer we bring water conditions to a perfect state, the less it is going to cost the people in the matter of health protection.

Dr. WILEY. If you will not tell the ex-mayor of Ottawa, I will relate a little incident that happened to me when I was in that city for the purpose of addressing the Canadian Club. It was, as you know, a noon function on a Saturday. The Duke of Connaught was there and many members of Parliament, and among others who happened to be there was a prominent justice. I spoke particularly of water-borne diseases, especially typhoid; about how important it was to safeguard the people of every community against this infection which is so prevalent in many of the cities of this country as well as the cities of Canada. Right across the narrow table from me there was a gentleman sitting, and I rather singled him out and was speaking to him personally about the importance of spending money to get a pure-water supply into the city. After the lecture was over the justice said to me, "You picked out the right man that

time for your lecture." I said, "What do you mean?" He said, "You were addressing his honor the mayor. Last winter the council of Ottawa appropriated \$400,000 to improve our water supply, and his honor the mayor vetoed the measure on the ground that it was a useless expenditure of public money." The very next summer, when I was in Iowa on the Chautauqua circuit, I picked up a morning paper and saw a dispatch from Ottawa and I thought, "I had better read this." It read: "The most dreadful epidemic of typhoid ever known in the Dominion has broken out in Ottawa, due to the pollution of the water. Already there are 500 cases. The disease is so virulent," it went on to say, "that all the politicians have left the city." I sent and got complete data of that epidemic, and found that 113 died, and these were only about 9 or 10 out of 100 that were affected, so you can see the number that was affected—over 1,000. You know how long and tedious the disease is. As a result of it people are often invalids for life. All the cost of that dreadful epidemic, with all its sorrow, suffering, and dead, would have been avoided by spending the \$400,000 to secure pure water.

That will give you some idea of how much of this loss of energy and this cost is due to water-borne disease. I would not like to speak as a prophet, but it would not be at all surprising if practically one-third of all the disease—that is, infectious disease—of which we suffer is due to that cause. Tuberculosis is often taken into the system through water and food as well as through the air. Yellow fever is a mosquito-borne disease, but typhoid, diphtheria, and diseases of that kind are water or food borne.

Mr. GLENN. Stomach troubles come, too, do they not?

Dr. WILEY. There are very many stomach troubles.

Mr. POWELL. I would like to get on the record a statement as to your exact official position, Dr. Wiley.

Dr. WILEY. I have none. I have not been an official for three years.

Mr. POWELL. Well, prior to that time.

Dr. WILEY. For 30 years I was connected with the Department of Agriculture. I was Chief of the Bureau of Chemistry, and was in charge of the execution of our pure food and drug law.

Mr. POWELL. And your work involved a study of these questions?

Dr. WILEY. Of these very problems. I am still studying these problems because I am editor of the department of Good House-keeping devoted to food, sanitation, and health. I am also president of the Pharmacopoccal Convention of this country and president of the National Month Hygiene Association.

Mr. GLENN. Doctor, on account of your knowledge and your position, I would like to get in the record an expression of your idea about the creation of this commission. One of its principal objects is for the purpose of protecting the health and the lives of the people on both sides of the line by looking after pollution. What do you think of the value to the country of such a commission?

Dr. WILEY. I think it is inestimable, not only on account of your work, but by reason of the principle involved between the two countries. It is an augury of the future which is certainly encouraging. Most of the international commissions have discussed many questions and things of various kinds. Now, here is one whose chief

purpose of far above that; the welfare of humanity. I think it is admirable.

Mr. POWELL. Outside of the particular point for which the Doctor was called I would like to take advantage of his being here to ask a few questions aside from the matter of pollution at Buffalo and Detroit. What is your position, Doctor, with respect to depositing raw sewage into a river at all?

Dr. WILEY. I am unalterably opposed to it under any circumstances.

Mr. POWELL. You think it is vicious and disastrous?

Dr. WILEY. It is vicious and disastrous and continually and increasingly dangerous.

Mr. POWELL. Now, take Buffalo. Would you think that purification of its water to some extent is absolutely essential?

Dr. WILEY. It is absolutely essential for all the people who live below Buffalo.

Mr. POWELL. What would your idea be with respect to the degree of purification that should be imposed upon cities like Buffalo and Detroit and other littoral communities?

Dr. WILEY. I should say that it should be sufficient to kill absolutely all pathogenic germs. The mere deposit of organic matter which is harmless is not so much of a threat, but as long as any germs of any disease, typhoid or diphtheria or tuberculosis or anything of that kind—as long as any of them are in the water it is not sufficiently purified to be safe. In that purification they necessarily remove most of the ordinary contamination by organic matter to which we object. It is necessarily removed or else it must be diluted and that is a mighty big job.

Mr. POWELL. Take the appliances for producing this purification. What in your judgment would be a fair requirement to demand of these littoral communities?

Dr. WILEY. I should say that they should build a purifying receptacle commensurate with the size in the near future of the various corporations which will hold easily and purify the whole of the sewage which they use. We are coming to that very rapidly.

Mr. POWELL. That is the septic tanks?

Dr. WILEY. Septic tanks or great filter beds or sedimentation tanks and filter tanks. Some cities have vast sand beds below them, agricultural areas that are of little value. There the sewage can be distributed over very large areas. That is done just below Paris. There they have converted a lot of sand beds into beautiful gardens. Of course they do not grow anything to eat in the soil, but on stems and vines.

Mr. MIGNAULT. They are sewage farms.

Dr. WILEY. Sewage farms; yes. New York City proposes to do that with its sewage, taking it to Long Island. The commission has proposed that as a solution of the New York problem. You can find nothing around New York upon which to build a sewage disposal plant. You have to go across into Long Island. There you find vast stretches of sandy land that are almost valueless for agricultural purposes. They propose to convert them into a garden, disposing of this vast amount of sewage at the same time. At other places we will have to build septic tanks. Baltimore had to do that, a very large one, and connect it with filtration.

Mr. MIGNAULT. Just for my own information. Baltimore is a city of about the size of Buffalo, is it not?

Dr. WILEY. There are about half a million people in Baltimore. I do not know the population of Buffalo.

Mr. TAWNEY. It is about 440,000.

Dr. WILEY. The two cities are about the same size, then.

Mr. MIGNAULT. What is the size of the septic tank at Baltimore?

Dr. WILEY. I have never visited it, but it covers many acres. They throw the sewage in a spray, and not in bulk. It is all sprayed onto this tank. There is a fine rain falling down on this charcoal-sand bed, and by the time it runs through it is all oxidized.

The CHAIRMAN. That is comparatively a new plant.

Mr. MIGNAULT. What is the estimated expenditure?

Dr. WILEY. That I could not say.

Mr. TAWNEY. Ten million dollars. That was stated by a Member of Congress from Baltimore a year ago last winter, when I was before the Committee on Foreign Affairs.

Dr. WILEY. Gentlemen, I hope you are going to succeed in your efforts to better the conditions of your boundary waters.

Mr. TAWNEY. In view of what Mr. Glenn said to you, Doctor, I wish to state that this is only one of the very many functions of the commission. He may have given you the impression that the investigation and recommendations respecting pollution of the waters was the chief function of the commission. It is only one of the many duties that the commission has to perform, or that the two Governments may call upon us to perform.

Dr. WILEY. I hope you will accentuate this one.

Mr. TAWNEY. I am not trying to minimize it, but there are others that, from the standpoint of international comity, are equally important with this one.

The CHAIRMAN. Dr. Wiley, we thank you for coming before us and giving us the benefit of your wide knowledge on the subject.

The CHAIRMAN. Prof. Phelps, the commission would now like to have a statement from you.

STATEMENT OF PROF. EARLE B. PHELPS, OF THE UNITED STATES PUBLIC HEALTH SERVICE.

Prof. PHELPS. I have listened with a great deal of interest to the various arguments in favor of this canal scheme of sewage disposal, and I think it will clarify our views immensely if we separate the two projects that have been so minutely brought together, namely, the power project and the sewage-disposal project. It may be possible—I do not know—that the power project has in it so much of profit that it can afford to handle incidentally the sewage-disposal project. But I wish to say that as a sewage-disposal project this thing is tremendously expensive, unnecessarily expensive; and from a broad view of public economy, even though the power project may have in it enough profit to cover a thoroughgoing sewage-disposal project, I can see no advantages in joining the two.

A great deal has been said about sedimentation. Dr. Wiley took his life in his hands if he drank the water from a septic tank after four hours' treatment, because the scientific facts are that such treat-

ment has absolutely no effect as far as the pathogenic germs in the fluid are concerned. The water is not crystal clear. No one would think of drinking it. It is a stinking, foul, black mess. What I think happened—in fact, what I know happened—was that Dr. Wiley drank the clarified water from the sand filter. That is why I asked him where he drank it. There were no septic tanks in Berlin at that time.

Sunlight is a factor in such purification, but the chief purpose is to get out the solid material, to get that into more convenient form for treatment by the organisms for liquefaction, so that the mechanical difficulties of operating the following treatments shall be removed; that is, the solid material is, by its very nature, clogging, and becomes an expensive item for further filtration or other treatment. So it is always necessary to get that out and get it liquefied in these septic tanks. One of two things is done. Either the stuff is held there long enough to be liquefied, so that it can be handled in liquid form, or else it has to be removed. Under natural conditions of sedimentation, such as would exist in this canal, that latter alternative would largely be the one that would have to be followed. In other words, all that sludge—and that is the peculiar sewage-disposal problem—would have to be handled by a very expensive process of dredging. That process, I say without hesitation, without having computed it, would be fivefold the cost of handling the same sewage sludge in sewage-purification tanks of improved design. So much for sedimentation.

As far as the other purification aspects go, as I have already said, in treatment of pathogenic organisms, the short-time sedimentation does not amount to anything. The long-time passage of water down through that canal would amount to something, but under the conditions that would obtain in that canal and which we can see to-day illustrated in the Chicago Canal, the purification of that fluid would be very much hindered, not increased any, by the slow flow under the septic conditions that would obtain there. It is true, as Dr. Wiley says, that our old view was that running water purified itself, and we later came to a view that standing water purified itself, and now we are coming into the view that running water is the most efficient purifying mechanism, from a purely scientific standpoint. The quiescent water takes longer to pass from place to place, and that is the only single aspect in which it can be said that slow-moving water is better than swifter-moving water. The swifter-moving water brings the pollution to the lower town quicker, and in that single aspect it is not so efficient. But time for time, given equal times, the agitated water is the most efficient mechanism for purification, because oxygen is the essential thing in purification, and the oxygenating work in a slow-moving stream is carried on very slowly indeed, only through the oxygen on the surface, where it is exposed to the air; whereas in a rapidly running stream the oxidation is continuous by agitation, and we have there the very maximum purifying effects. I think it is well to get these matters plain on the record.

This scheme, therefore, will be face to face, not in the far future but at present, from the very day of its start, if it is honest in its promises, with a very serious purification matter. It can not be left to nature; it has to be taken care of. It has been stated that 6,000

cubic feet per second would be the flow, and it has been suggested that treatment by calcium hypochloride might be a feasible scheme for purification. I have just made a rough computation, and it will cost not less than \$2,000 a day to chlorinate any such body of water, to be worth anything at all. Anything less than that would be wasted money.

Mr. MAGRATH. That is, the chlorination of the 6,000 cubic feet?

Prof. PHELPS. Yes; the chlorination of the 6,000 cubic feet. There again the folly of mixing the two things becomes apparent. It would not cost anything like that to chlorinate the sewage, but the less efficacious way would be to mix it in a large body of water and chlorinate.

It has been suggested that these things will be controlled by Government permit. I assume that is the permit of the War Department. The War Department has repeatedly stated, and is on record in the case of the improvement of the New York Harbor, that its interests are not in any way connected with sanitary aspects, unless in the single case of a Government work in a port, like Governors Island, in New York Harbor, which is so situated that its own inhabitants are affected. In other words, the Army engineers are not at all interested in typhoid fever. All they are interested in is deposits and obstructions to navigation, and any project can have their approval, as projects for the putting of crude sewage in New York Harbor have their approval, if they can be convinced there will be no interference with navigation. That is all they are interested in, and they did serious harm to the cause of cleaning New York Harbor by the granting of a permit to that Passaic Valley sewer, which is a very serious menace to the condition there.

Mr. GLENN. The matter having been referred to us for recommendation to the two Governments, suppose we should decide to recommend this canal, and put in that recommendation that before it should be granted by the two Governments these people should be required to enter into security to the two Governments to see to it that this water was amply purified before it was emptied into Lake Ontario, thereby making them purify, instead of the city of Buffalo. Would not that be a better plan for the city, and equally as good for the country, if that was required of them?

Prof. PHELPS. Not in a broad, economic aspect, surely. If that power has enough profit in it to make it possible to purify the sewage by an exceedingly expensive process, then there ought to be some way of getting that process out for the benefit of the people, and not wasting the money. It may be that our laws are so arranged that the people can not get the value of that power. It may be they have to give it away in order to use it at all.

Mr. GLENN. Dr. Wiley stated a while ago that he thought direct treatment by the city before emptying into the Niagara River would, perhaps, be preferable to this. But would it be more costly?

Prof. PHELPS. No, sir.

Mr. GLENN. It would not?

Prof. PHELPS. Very much cheaper, if you assume that this canal is going to purify.

Mr. GLENN. Assuming that all the time.

Mr. MAGRATH. As I understood the testimony of Gen. Gorgas, it was that the sewage should be treated as it is being discharged into

the canal at the various points, so that you would have practically the same system along the canal as you have along the river to-day.

Prof. PHELPS. That would be equally costly, either way; in other words, the city is going to make a deal with the canal company to undertake that project in return for a grant of a very much more valuable thing. They are giving away something. If the laws are so framed that they can not avoid giving that power away, if they can not sell it, it is more fundamental, and I have not anything to say. If that is the best deal the city of Buffalo can get out of this thing, I have not anything to say. But, from a broad economic aspect, it is an economic loss, and in any event the cheapest way to purify the sewage is at the sewage outlets, and never after it is discharged into the canal.

As far as this commission's establishing control over the matter is concerned, if they recommended it—in answer to Mr. Glenn's first question—that would be entirely proper in so far as the sanitary protection is concerned, if that were hedged in with proper specifications and you had proper authority for control.

Mr. GLENN. They would also have to be bolstered up with the idea that they could carry it out.

Mr. POWELL. There is one thing I would like to have an explanation of. I have a theory of my own in which I may be wrong. You speak about it being much more expensive to purify a body of water where the sewage is being extensively diluted than it would be to purify the sewage taken by itself.

Prof. PHELPS. Yes, sir.

Mr. POWELL. Am I right in my understanding of the reason for that—that the larger particles being distributed through a much larger volume of water would require throughout that whole body the same strength of solution of chemicals to reduce the solid matter, and in that way it takes a much larger quantity at the same degree of intensity than it would if this were put in one stream by itself?

Prof. PHELPS. That is a very good statement of the chemical matter involved. It would not take the same strength, but the idea is correct. It would take more than the proportional strength indicated by the solution.

Mr. POWELL. That is how it works out?

Prof. PHELPS. Yes.

Mr. MIGNAULT. It is cheaper to localize the purification?

Prof. PHELPS. That is true.

Mr. POWELL. Because they have to have the solution to a certain strength in order to do the work?

Prof. PHELPS. Yes.

Mr. POWELL. And you require a much larger quantity of that solution?

Prof. PHELPS. In a larger volume of water. That is all I have to say on that subject.

Mr. Magrath asked an interesting question. I consulted our census figures here, and I think I can give you some figures on the question of the proportion of cost. The total death rate in our registration area is 1,755 in 1910, per hundred thousand, annually. The typhoid death rate for the same area is 32. I think it may safely be assumed that one-half of that typhoid in the United States comes from water. It is much less than that in the South, much more

than that in the North, and in thinking the matter over I think that would be a round figure. But it does not matter. One-half of that would be just 1 per cent; all of it would be 2 per cent. It is somewhere between 1 and 2 per cent of the total sickness and death in the country that is due to typhoid fever. Typhoid fever is the principal water-borne disease. There are other things that do not kill people—intestinal troubles, and possibly some infantile disorders, infantile diarrhea, etc. Those would not equal the typhoid, either in existence or time. But in round numbers, 1 or 2 per cent of the total death rate and sickness and suffering and cost, and all those things, are probably due to typhoid fever.

Mr. POWELL. That percentage would not at all represent the loss of time through disability on account of disease, when you take into account the fact that typhoid fever runs a much longer course than the others.

Prof. PHELPS. Pardon me, but I think on the whole it is probably a good average. For instance, we have tuberculosis, which kills a man in 25 years, and for the last 10 years he is incapacitated. On the other hand, we have diphtheria, which takes off a child very quickly. I think, perhaps, the cost, expense, loss of time, and all those things, in the case of typhoid, is pretty nearly the average.

Mr. TAWNEY. In diphtheria the after effect, as it is generally called, very frequently creates disabilities in the child. I know, because I have gone through with it.

Prof. PHELPS. Yes. I think typhoid is less than the average.

Mr. POWELL. Take the great volume of disease; it is infantile, is it not?

Prof. PHELPS. Yes.

Mr. POWELL. When you take that into account, the loss of labor is nothing?

Prof. PHELPS. No.

Mr. POWELL. So that the percentage of loss of labor would be very much increased in the case of typhoid fever?

Prof. PHELPS. As against that single thing. But on the other hand tuberculosis, which is our great killer, is just the other way. It is a matter of years and years.

Mr. POWELL. So, evening it up, you think it is about the same?

Prof. PHELPS. I think typhoid is about a fair mean average.

Mr. MAGRATH. What was in my mind was that it would appeal to the man on the street to be able to say, "You have a certain number of doctors doing business in your community; you have a very fair idea of what they are making per year; you know how much your hospitals are costing you; and of the total amount we believe that the proportion due to water-borne disease is a certain percentage." That is what I was trying to get at.

Prof. PHELPS. Yes; I saw your point. It is not over 1 per cent, because there are other things that produce the total.

Mr. MAGRATH. That is to say, 1 per cent of the total cost on account of health?

Prof. PHELPS. Yes; rather on account of sickness.

Mr. MAGRATH. On account of sickness; yes.

(Thereupon the commission went into executive session, at the conclusion of which an adjournment was taken.)



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